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BULLETIN 6013
SIZE 0S-6 FORM MC
ACROSS-THE-LINE
MOTOR STARTER

AVAILABLE

Open or enclosed.

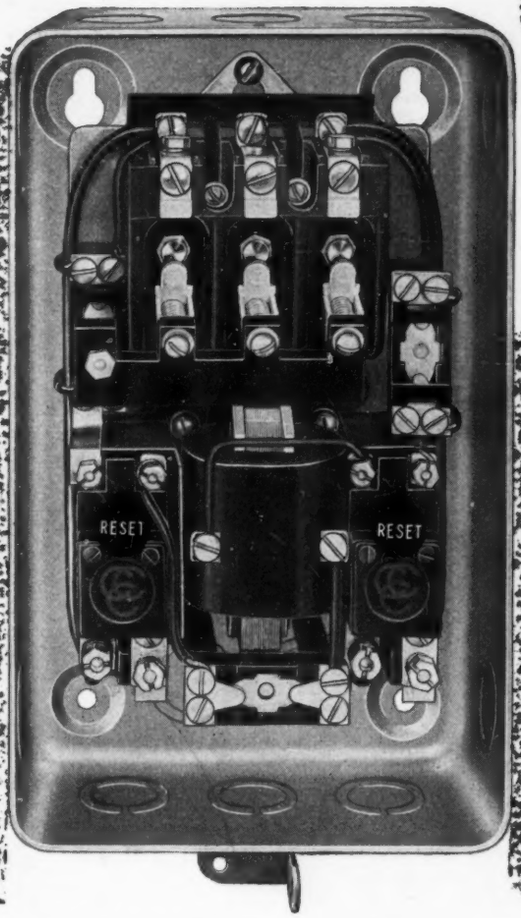
With normally open or normally closed control circuit contacts.

In single phase or poly-phase types.

In Form MA, with Overload Reset Button in Cover. Separate Pilot Device required.

In Form MB, with "MANUAL-OFF-AUTOMATIC" Switch and Reset Button in Cover.

In Form MC, with "START" and "STOP-RESET" Button in Cover.



HUSKY FISTS STILL FIND PLENTY OF WIRING SPACE!

LOOSE—But do not Remove! ...ocket in kerosk sleeve type heater, leaves in locked mount-ing lock of the bottom heater as pictured and the entire as-sembly lifts out.

RATING

Volts	Maximum H.P.	
	1 Phase	3 Phase
110	3	10
220	5	15
440	5	25
550	5	30

These starters consist of a multi-pole Bulletin 7707 A.C. Contactor and a two-element Bulletin 7323 Thermal Overload Relay.

CONTACTOR—The Bulletin 7707 Contactor combines the use of entirely visible Double Break Silver to Silver Contacts, and a Vertical Lift Magnet. The entire assembly mounts on a steel mounting plate designed for quick removal from the cabinet. The Contactor features include extra large electrical clearances, and easily accessible large size terminals for wiring. The mechanical design provides for very long life on frequent operating service.

OVERLOAD RELAY—The Bulletin 7323 Thermal Overload Relay is of the Solder Pot design. While reliable in operation if any damaging overload occurs, the Relay will not trip out unnecessarily on normal starting, nor on overloads which are not injurious to the motor. The heaters are enclosed in covers, so that stray air currents will not affect operation.

WIRING SPACE—Exceptionally large wiring space is provided and Concentric Knockouts in top, bottom, sides and back provide means for bringing in leads at the most advantageous points. A quick glance at the full size open view on the opposite page reveals the ample area for wiring, and the easily accessible terminals.

CONTROL CIRCUIT CONTACTS—This starter is available with Silver to Silver, double break, normally open or normally closed control circuit contacts.

PUSH BUTTONS—All Push Button operating mechanisms mounted on the cover have large diameter, and are fully protected against accidental operation. "STOP-RESET" buttons are common to prevent destructive attempts to re-start after overload tripping before solder has solidified. No flexible leads are used between cover operating mechanisms and other devices.

CABINETS—Cabinets are of heavy drawn steel, finished in Machine Tool Gray, and provision for locking is made.

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WATER WORKS & SEWERAGE, July, 1940, Volume 87, Number 7. Published monthly at 330 South Wells Street, Chicago, Ill., by the Gillette Publishing Company. Per copy, 25c. Subscription rate, United States and Canada, $2.00 per year; Foreign $3.00 per year. Copyright, 1940, Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under Act of March 3, 1879.

Grand Rapids INSTALLS NEW STEEL WATER MAINS

SHIPMENT OF NATIONAL *Steel Pipe, 54-in. I.D. x 9/16-in. wall x 120 ft. long, for Grand Rapids' new Lake Michigan intake line. Shipped in 120-ft. lengths, the pipe required three flat cars for each load.*

NATIONAL STEEL PIPE CHOSEN FOR LARGE INTAKE LINE AND CITY FEEDERS

LATEST addition to the growing list of American cities taking advantage of the economy and safety of steel water mains is Grand Rapids, Michigan. Soon to go into operation is a new 54-in. intake line which will extend 5980 feet into Lake Michigan, together with 21,000 feet of 42-in. and 36-in. feeder lines in the city, all NATIONAL Steel Pipe.

Grand Rapids' decision to use NATIONAL Steel Pipe in this new water project typifies the current trend toward the use of low-cost, non-breakable, high-strength pipe in municipal and industrial water mains. Hundreds of steel pipe water main projects are now in service in the United States, and many more abroad. Data on old installations, some 60 years old, indicate that the life of steel water mains has been underestimated. NATIONAL Pipe is made to rigid specifications and approved by Underwriters' Laboratories, Inc.

Greatest Service at Lowest Cost ...WITH STEEL WATER MAINS

1. Steel pipe has high tensile strength . . . withstands high pressures and trench loads. Resists the effects of vibration, sudden shocks, cave-ins, washouts, ground settlement, water hammer and other emergency stresses.
2. Steel pipe comes in long lengths, reducing the number of joints per mile. This means faster laying, less leakage, less damage to pavement, lower water loss per mile.
3. Steel pipe is light in weight . . . saves freight and trucking charges, and speeds laying operations.
4. Steel pipe does not shatter . . . eliminates sudden interruptions of service in case of fire or other emergencies . . . reduces property damage.
5. Its smooth surface is ideal for application of dips or coatings, where necessary, and gives it greater carrying capacity—a high value of "C", the Hazen-Williams coefficient.
6. Steel water mains in service more than fifty years indicate that steel pipe in many cases will last far beyond the time when expansion of capacity becomes necessary. According to nation-wide tests, in only 5 to 10 per cent of this country's area is soil corrosion serious enough to become a controlling factor. Where soils are bad, protective coatings are available.

THE TREND TOWARD STEEL WATER MAINS

Steel water mains 20-in. and over installed in U. S. municipal service during 10-year periods. Figures for 1931-1940 are complete only to 1935. Bracketed area indicates estimated total for 1936-1940. From Underwriters' Laboratories, Inc. report on Steel Pipe Lines for underground water service, special investigation 888.

NATIONAL TUBE COMPANY

PITTSBURGH, PA.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Export Company, New York

UNITED STATES STEEL

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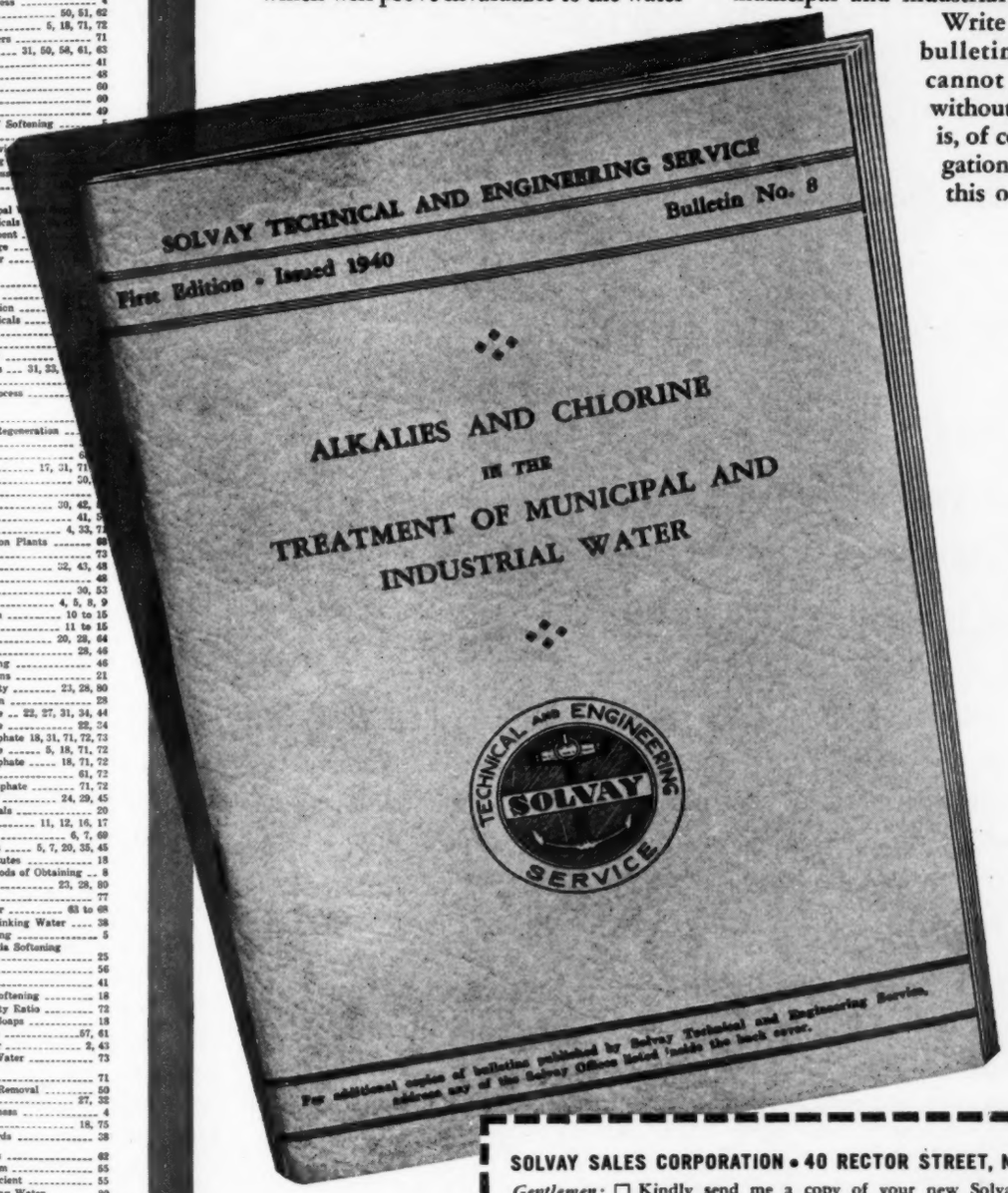
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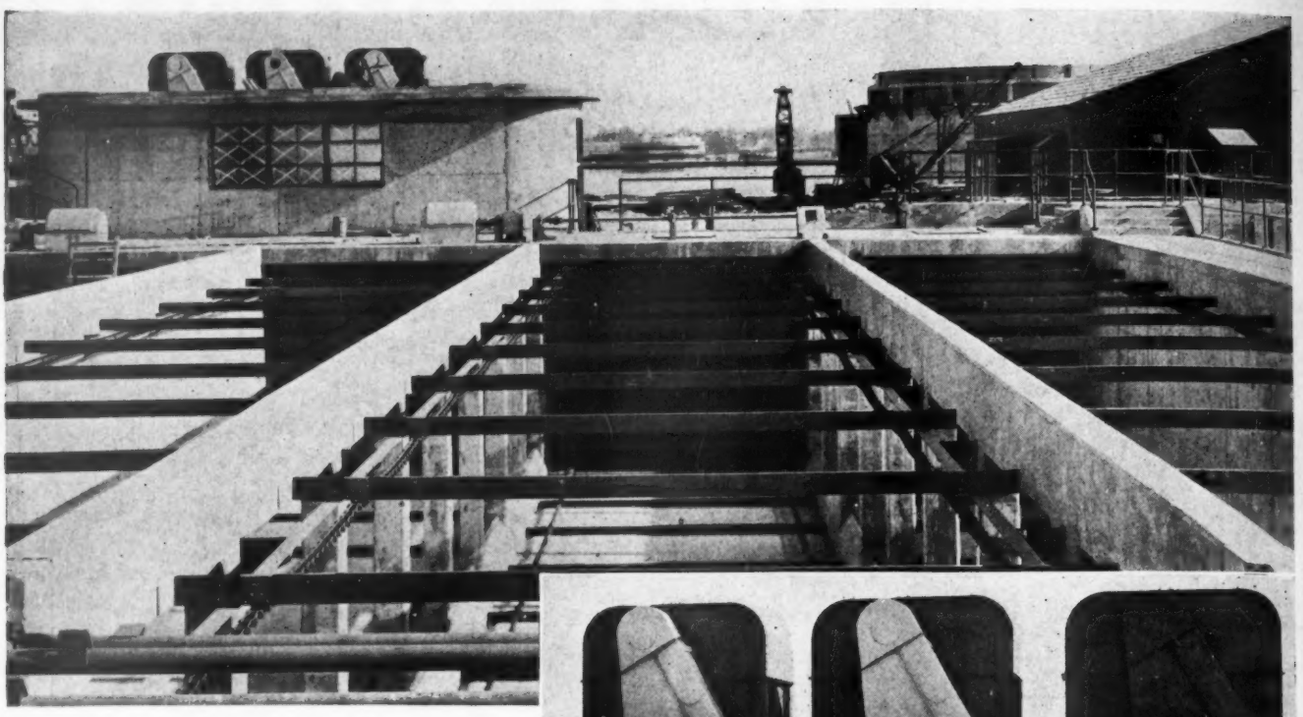

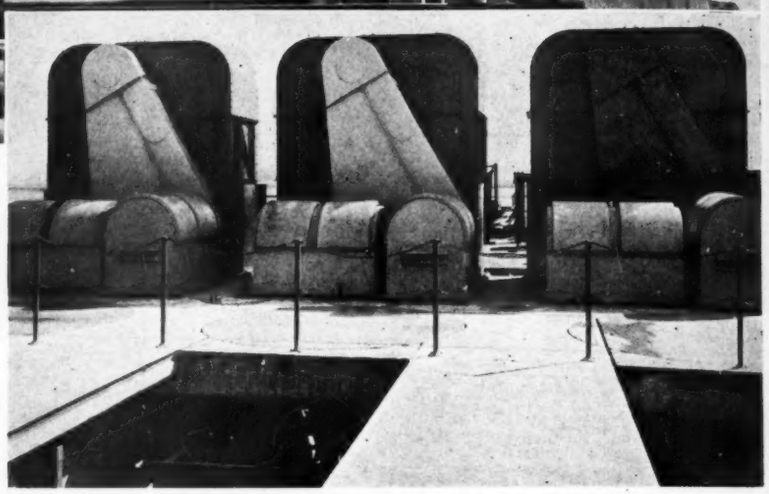

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- **Floctrols**
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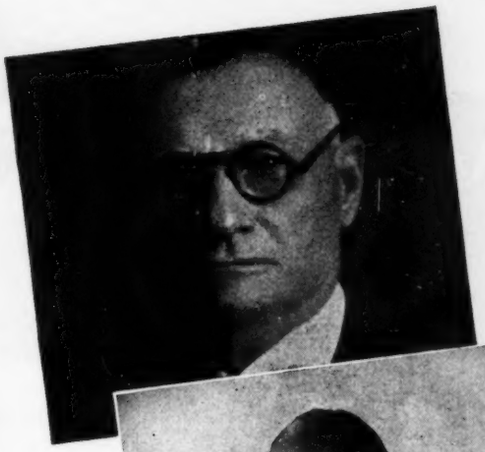

Says George E. Symons of his father,

"To condense into one page the professional life of a man like Martin, as all his men call him, is unfair. . A period of service like his deserves a volume. . He takes his job seriously, believes firmly in the credo of the public utilities servant, 'It's got to go' . . Packing men ask his advice, pump men seek his counsel on valves, professors have brought classes to see how he wets coal to make it burn better. He can still look at an alum floc and tell how well the water will filter. He likes to tell the story of how No. 1 High Service Pump was started the day I was born, and how the filter plant began operations when I was forty days old . . (His) plant is the most economical in the State . . 'Martin' is the dean of operators in Illinois, with service since 1895."

(upper)
Martin M. Symons, Chief Engineer, Interstate Water Co., Danville, Ill.

(lower)
George E. Symons, M.S., Ph.D., Chairman, Committee on Sewage Research, New York State Sewage Works Association.

● The Symons first became acquainted with the virtues of Mathieson Chlorine in 1916 when it was introduced in the Danville plant, of which Martin M. Symons has been Chief Engineer since 1909. Since that time, both father and son have used Mathieson Chlorine throughout their long careers in sanitary work.

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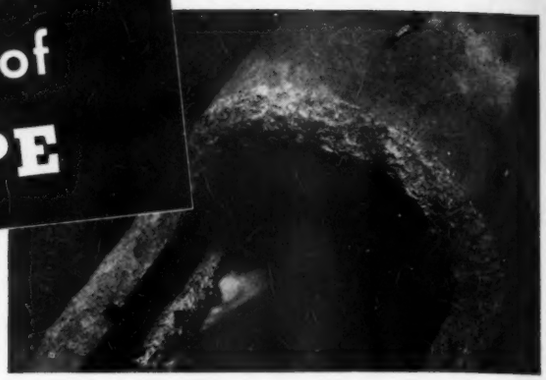

MINNEAPOLIS, MINN.—12-in. concrete pipe sanitary sewer installed in 1886. Found to be in excellent condition in 1933, after 47 years. Minneapolis has more than 35 miles of this old concrete pipe in its sewerage system today.

Since the inception of sewerage (water carriage), concrete pipe has been used for building sanitary, combined and storm sewers. The concrete sewer pipe pictured here are veterans with service records up to a half century and more. The sewers of which they are a part were found on inspection to be in excellent condition.

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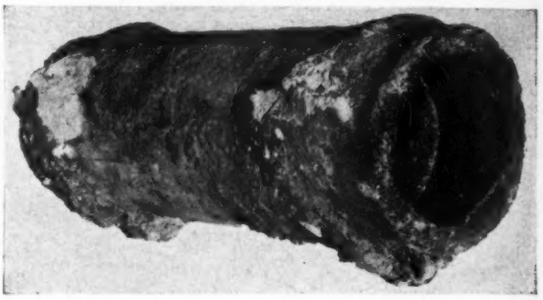

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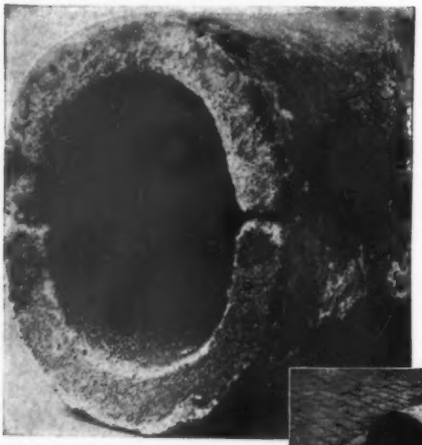
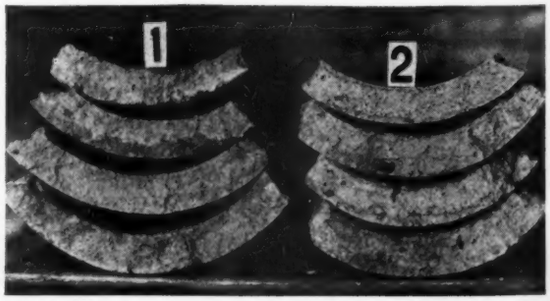


NEWARK, N. J.—Condition of this concrete pipe was found excellent after 58 years—1867 to 1925.

SAVANNAH, GA.—Concrete pipe sanitary sewer installed in 1870; condition excellent at inspection in 1927.

KOKOMO, IND.—This 15-in. concrete pipe sanitary sewer was still in good shape after 48 years—1874 to 1922.



ST. PAUL, MINN.—Test specimens of 12-in. concrete pipe sanitary sewer in excellent condition in 1931 after 45 years.

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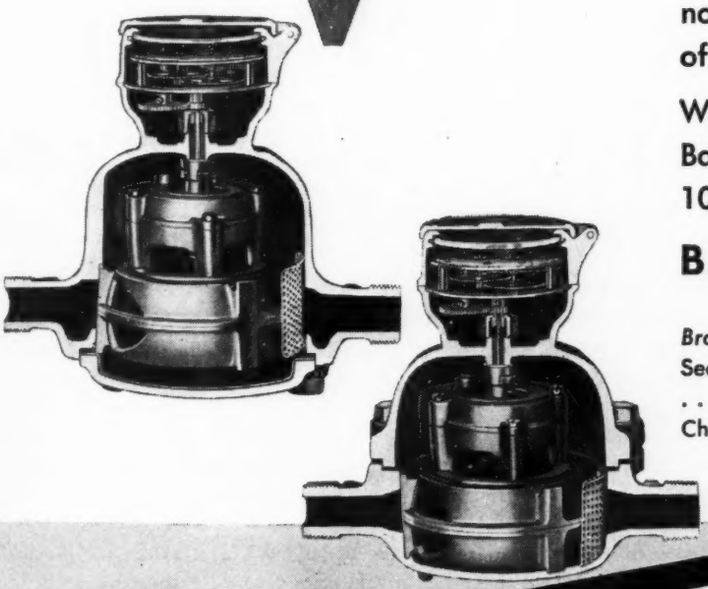

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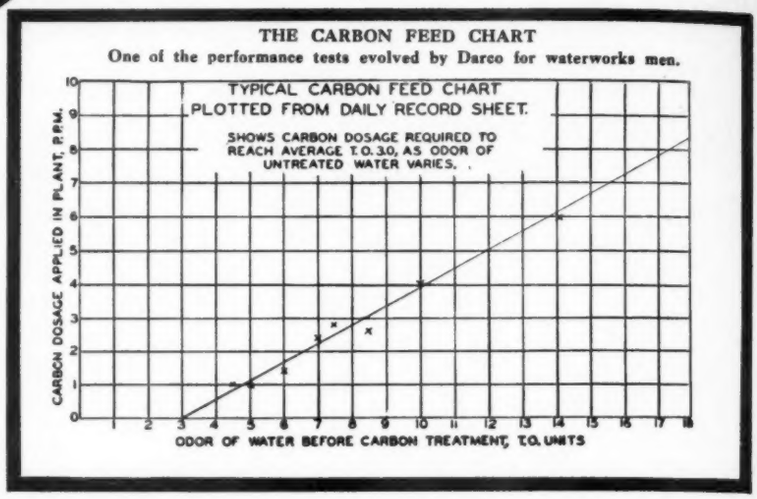
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● *Illustrated below is the new 1,000,000-gallon Horton radial-cone bottom elevated storage tank which has been installed at Albert Lea, Minn.*

EXAMPLE: Albert Lea, Minn.

TEACHER: "The city of Albert Lea, Minnesota, installed a new elevated tank which holds a million gallons of water. It was designed to improve service to consumers and to help the City reduce its power cost for pumping. Previously, a smaller tank was used. The City was charged at the rate of $.022 per Kwh for pumping water, regardless of the time of day the pumps were operated. By installing the new tank the city was able to secure a rate of $.015 per Kwh with the provision that all pumping would be handled during off-peak periods. If, in case of emergency, it should be necessary to pump during on-peak periods a demand charge of $1.25 net per Kw applies."

"Now, how much do they save in power costs per Kwh when water is pumped only during off-peak periods?"

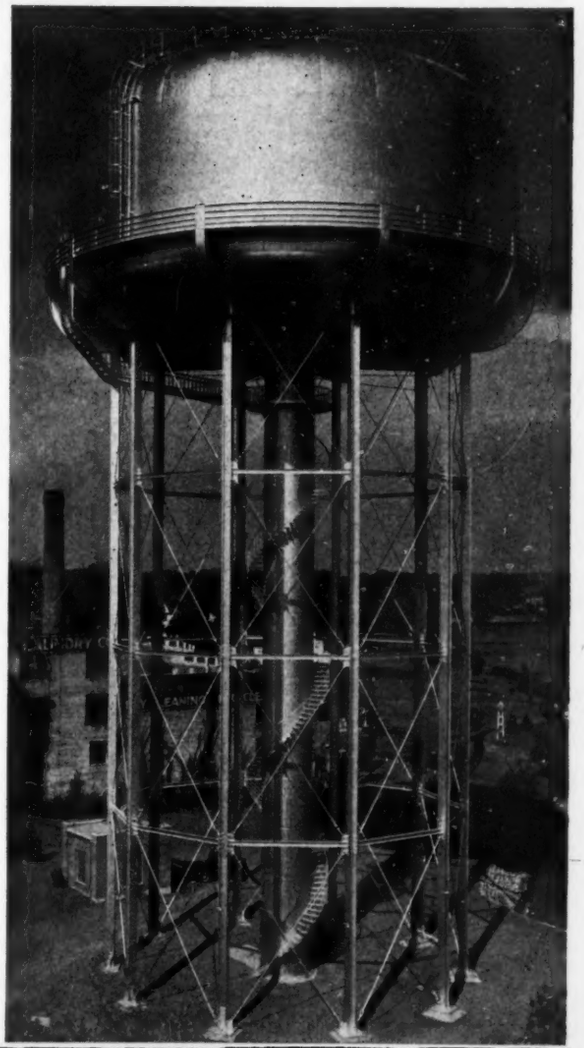
PUPIL: "The City saves seven-tenths of a cent per Kwh."

TEACHER: "Correct. If they pump a million gallons at the new rate, how much would they save — assuming it requires one Kwh of electricity to pump a thousand gallons?"

PUPIL: "The saving would be $7.00 for each 1,000,000 gallons."

TEACHER: "That's right. Now can you tell me what the City would save for an entire year, if they pump 28,961,666 gallons every month?"

PUPIL: "I can't give the exact figure off-hand, but I know it should be over $2,000.00 a year."



The pupil was fairly accurate. According to the City Engineer of Albert Lea, Minn., it is estimated that savings in pumping costs will be approximately $2,432.78 per year, based on the previous year's pumping figures. This is an excellent example of the important part elevated storage is playing in municipal water supply systems. These benefits are available to cities in all sections of the country, where similar problems exist. Write for information.

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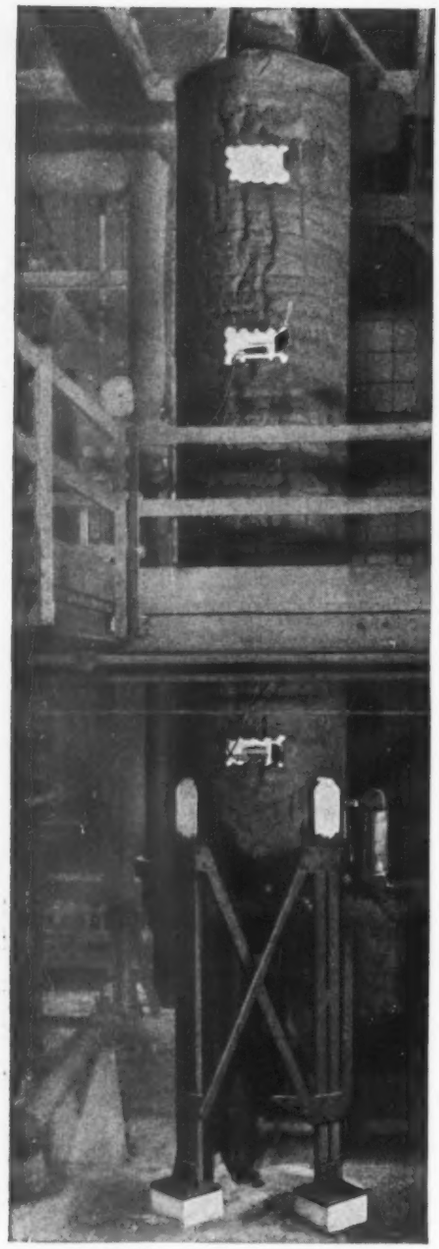

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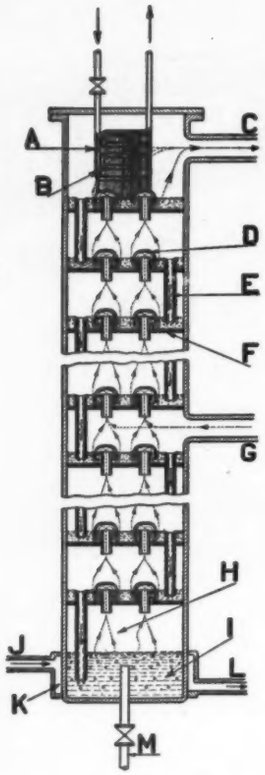

A. Refrigerating Coil
B. Condensing purified chlorine
C. Purified chlorine outlet
D. Bubble cap
E. Downtake for reflux
F. Tray or plate
G. Raw chlorine inlet
H. Chloroform vapors
I. Chloroform and dissolved impurities
J. Steam inlet
K. Heating jacket
L. Condensed steam
M. Drain for impurities

Operating Diagram of the Chlorine Fractionating Column

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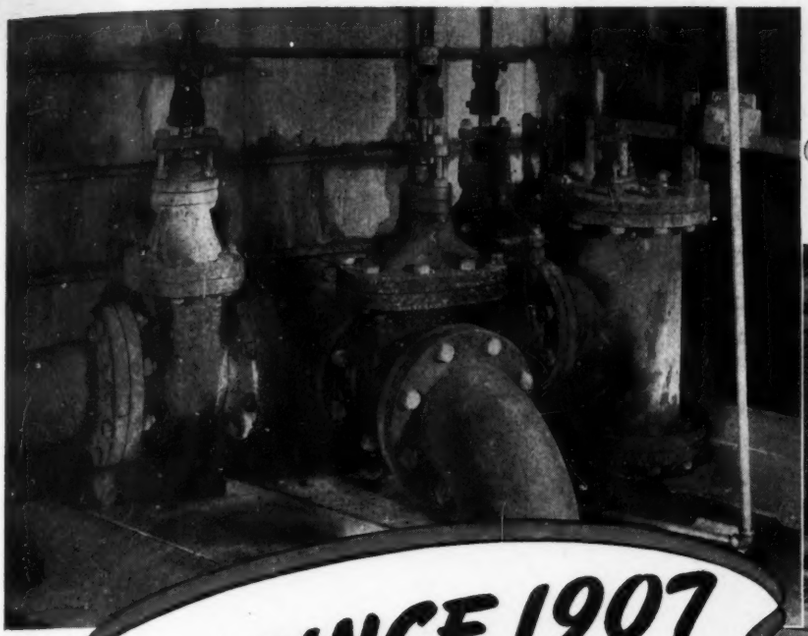

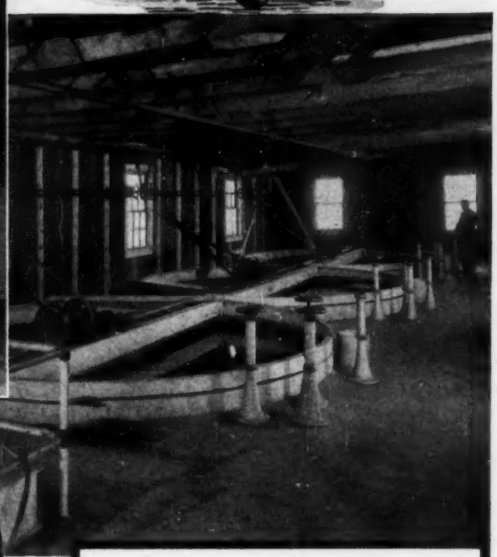

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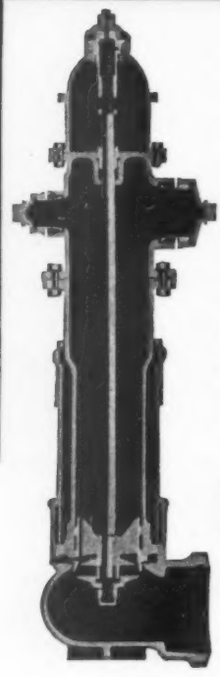

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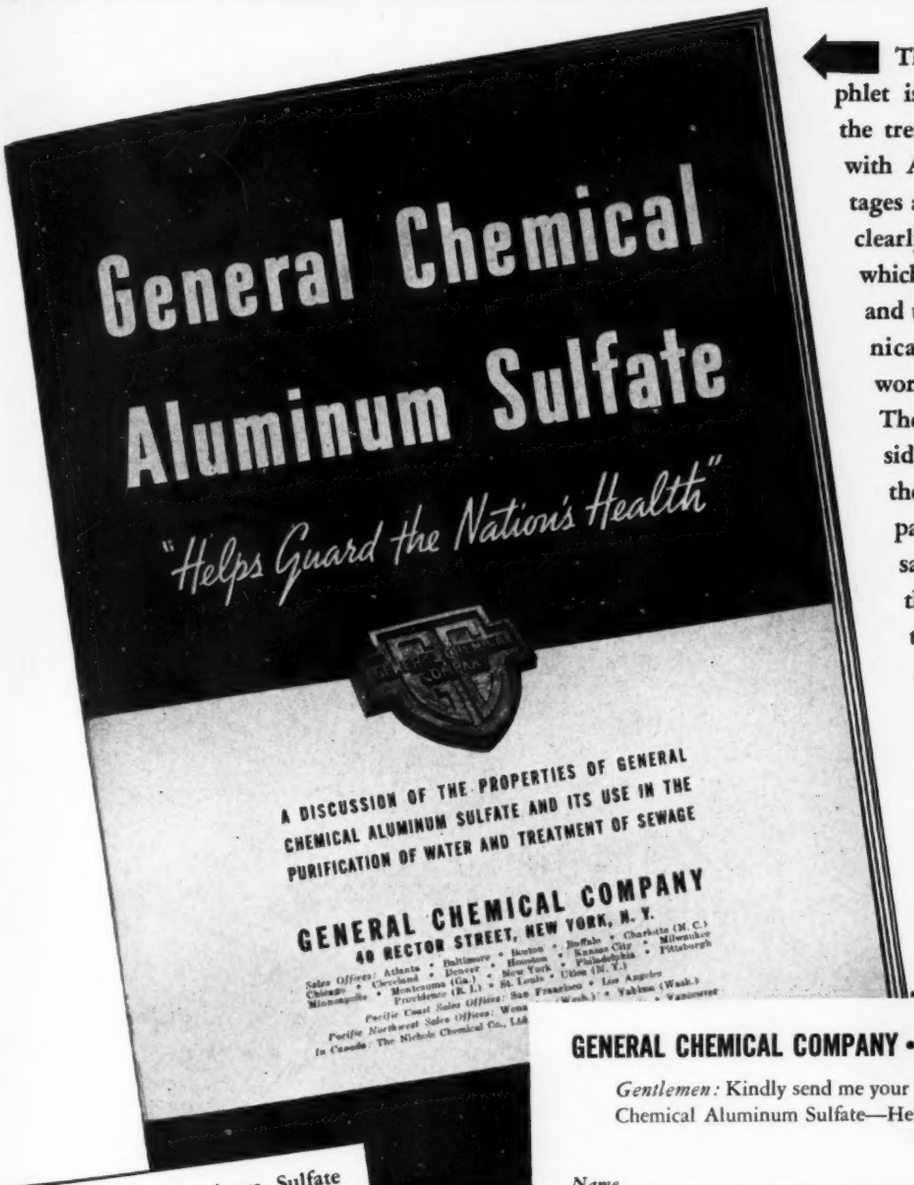
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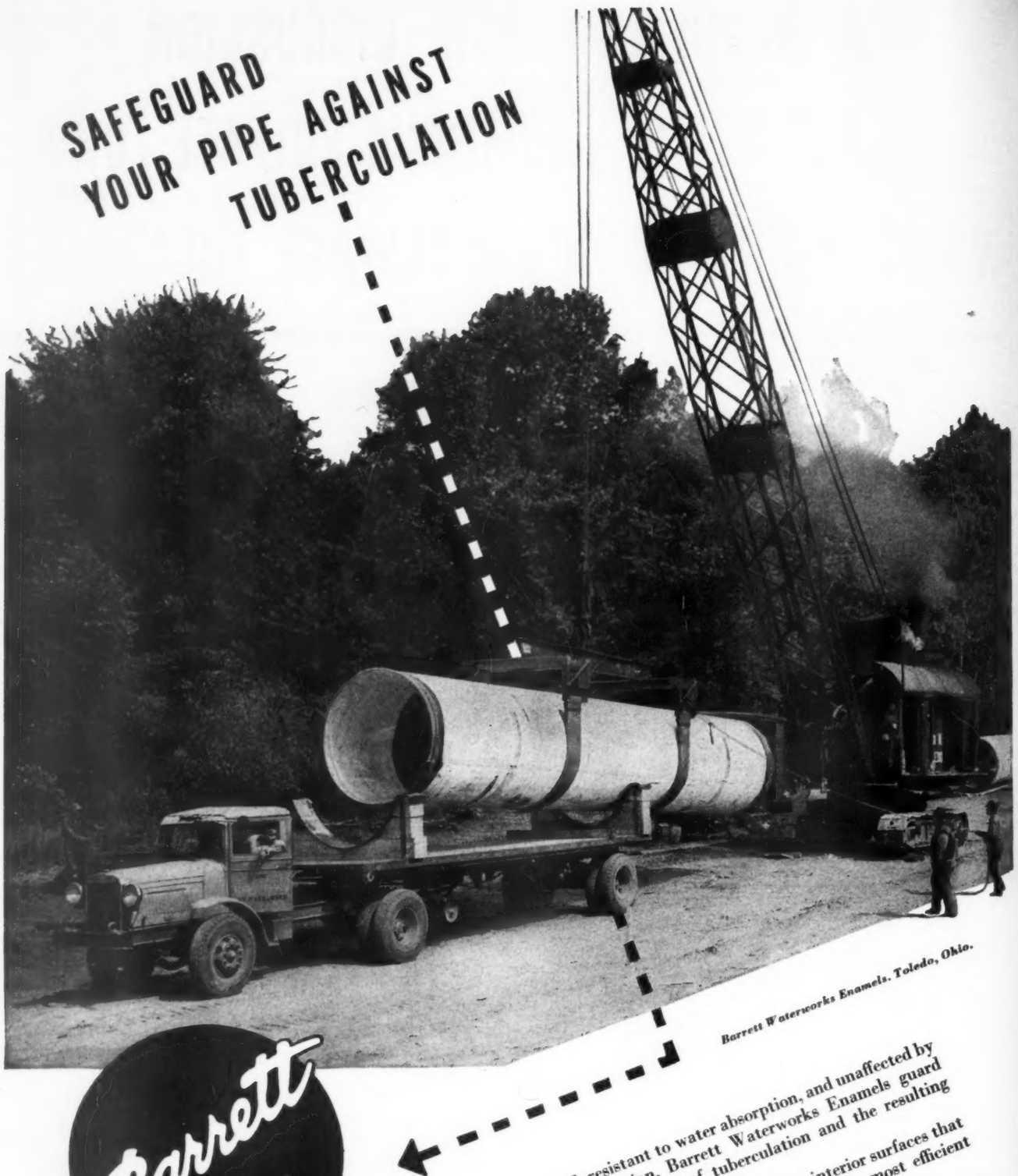

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"The New Softening Plant of Ann Arbor, Mich."
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HENRY H. CASWELL, Manager
HARRY T. McENTEE, Plant. Supt.

"Rapid Sand Filters for Sewage and Trade Wastes"
Is the subject covered in the author's usually thorough and effective manner in two articles dealing with the present status of the practice of mechanical filtration of sewages, wastes and effluents. In this article the equipment now available on the market for such purposes is described, and features discussed. With performance data and operating results touched upon, these articles will comprise a reference work of value to engineers and plant managers interested in improved effluents and operating economy. The author, with many years of mechanical filter experience as a background, is—
PHILIP B. STREANDER, Consulting Engr.
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"Hydraulics in Water and Sewage Works"
Is a discussion of the fundamental principles most frequently met with in operating water works and sewerage systems. Accompanying the article are two discussions amplifying this important topic. All are written for the "run of mine" operator, but particularly the type that finds attendance at short schools of great benefit. The authors—
MARION L. CRIST, Engr.,
Little Rock, Ark., Water Dept.
PROF. EDW. R. STAPLEY,
Oklahoma A. & M. College
HENRY E. NUNN, Engr. & Supt.,
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"Treating Incrusted Wells"
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JOHN A. GOETZ, Supt. and
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Mattoon, Ill., Water Department

"Maintenance of Sewage Pumping Stations"
Without much fear of being contradicted we can say that this article, dealing with maintenance of sewage pumps and pumping station facilities, is the most complete and definite of any that has ever come to our attention. Written by an operator with high capabilities and a background of experience, this article is one to be studied religiously. It should serve as a maintenance and operation guide for time to come, and readers charged with pumping station operation will find its value grows with each reading.
The author—
A. L. SODEN, Chief Operator
Sewage Pumping Stations, Trenton, N. J.

'Experiences With Publicity Methods"
Constitutes a story of how the successful program of "selling" the Portland Water District supply and services to the public was accomplished, at reasonable and justified expense. The article comes from—
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Portland Water District, Portland, Me.

"The Results of Better Maintenance and Sizing of Water Meters"
Are told by an author directing operations of a water department that has made a very thorough study of proper sizing of water consumers' service meters, and how far to go in testing and overhauling such meters. Experiences and results in this and other methods of reducing the "unaccounted for water" figure are told by—
H. W. GRISWOLD,
Deputy Chief Engr. and Mgr.
Water Bureau of Hartford, Conn.

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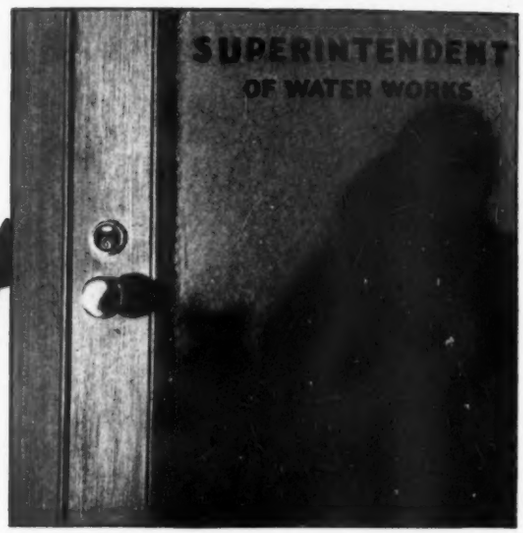

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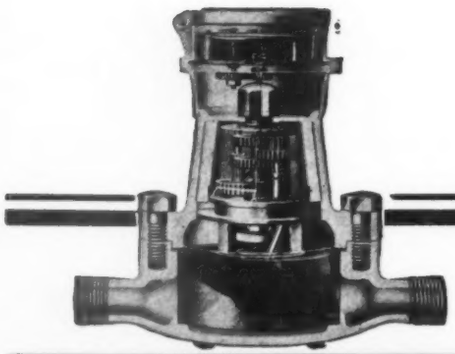

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WATER WORKS & SEWERAGE

VOL. 87, NO. 7 *A Gillette Publication* JULY, 1940

SOFTENING PLANT OF THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

II.—Features of the Plant Design

By CHARLES P. HOOVER,* J. M. MONTGOMERY,* W. W. AULTMAN†

(Second of Three Articles)

THE softening and filtration plant now under construction at La Verne, California, (see location map in the June issue) for The Metropolitan Water District of Southern California, is unique not only in the process being used but also in many features of plant design. This does not mean that the plant is to be considered as experimental, for no untried or unproved process or equipment will be found in the entire project.

Softening will be accomplished by using lime to remove calcium bicarbonate hardness, followed by the zeolite process to reduce the remaining hardness to the desired point. This scheme of treatment has been used before, but never on such a scale as in this plant. Nowhere, in fact, has zeolite ever before been used in such large quantities. The initial unit, now under construction, will have a capacity of 100 m.g.d. The ultimate capacity will be 400 m.g.d.

* Hoover and Montgomery, Consulting Engineers, Columbus, Ohio.
† Engineer, The Metropolitan Water District of Southern California, Los Angeles, California.

As will be seen from the layout and design data (Fig. 1), the plan resembles a conventional lime-soda plant with the addition of zeolite softener units, but with a reduction in the numbers, sizes, and capacities of various items such as chemical feeding, handling and storage equipment, flocculators, settling basins, sludge removal equipment, carbonation equipment, etc. The flow sheet (Fig. 2), shows the steps in the process and diagrams the flow of water through the plant.

Location Required Automatically Synchronized Operations

The design was complicated by the fact that the plant is located 36 miles from the Cajalco Reservoir, where the intake may be said to be located. In the pipe line between the reservoir and the plant, which line is from 116 inches to 152 inches in diameter, there are no spillways and there can be no regulating valves. There is a 265-foot difference in head between the water level in the plant and high water level in the reservoir, and the pipe line is not designed to withstand the surge pressure which would result from stopping or sudden throttling

This is the second in a series of three articles describing what will soon be America's newest and most modern water softening plant—that of the Metropolitan Water District of Southern California.

The first article of this series, which appeared in the June issue of this magazine, dealt with the quality of water taken from the Colorado River and technical and economic reasons for selecting the lime-zeolite process for treating it. The present article emphasizes the interesting and unusual design and operating features to be found in the new plant.

The third article will discuss "Lime Reclamation" as a considered feature. This concluding article will relate experiences with this phase of water softening, looking to operating economy and, to a large measure, yielding a solution to the worrisome sludge disposal problem.

the flow of water at the plant. Consequently, all water entering the aqueduct at Cajalco Reservoir, at whatever rate, must flow unobstructedly through the plant, be properly treated, and returned to the aqueduct. The plant is, therefore, designed in the line, so to speak, and the chemical feeding equipment, filters, and zeolite softeners, had all to be designed to operate in proportion to the rate of flow of water through the plant.

As the water enters the plant through the head-house it will be measured by means of propeller-type meters, which control the operation of all of the chemical feeding equipment, with the exception of the chlorinators. For each 250,000 gallons of water flowing into the plant, an electrical contact will be closed which, through proper circuits, will cause the feeders to introduce the correct amounts of chemicals to treat that quantity of water. Feeding for the most part will be done intermittently (i.e., one feeding period for each 250,000 gallons of water), but the irregularities will be smoothed out in the chemical dissolving tanks, the flocculators, and the basins. Lime, alum, and other bulk chemicals will be measured and fed by weight. Carbon, ammonium sulfate, phosphates, etc., will be made up in solutions, or suspensions, of known strength and measured by volume. Chlorination will be automatically controlled by the main effluent venturi meter.

Special Carbon Handling

Activated carbon is to be stored in tanks located as far away as permissible from the main plant. Upon delivery, it will be dumped immediately into the tanks and made up into a water slurry of known strength. Pumps controlled by the raw water meters will transfer the carbon to the points of application. Two such wet storage tanks, each with a holding capacity in excess of one carload of carbon, are being provided. Each tank will be equipped with a bag opener, mechanical agitator, and dust control devices.

Both pneumatic and mechanical elevators and mechanical conveyors will be provided for handling bulk chemicals. Lime will be received direct from the kiln, and may actually be hot when delivered. Consequently, a lime cooler is being installed. This unit will also fit in which future lime reclamation facilities.

Aqueduct Turn-out Structure Shunting in the Plant
(Note the 72" valves in duplicate, as a characteristic precautionary design feature.)

"Re-circulated" Carbon-Dioxide

Ultimately, it is planned that facilities for producing lime from reclaimed sludge will be installed, after which time the required carbon dioxide will also be available from the lime kiln. Carbon dioxide for carbonation will be generated initially by burning natural gas or oil. The natural gas or oil will be burned in a heating unit which will produce all of the hot water required and will provide the necessary heat for the building in winter. The principal use for carbon dioxide will be for correcting the pH of the water flowing to the Zeolite softeners. The application of the carbon dioxide and the rate of combustion will be controlled automatically by means of pH regulating equipment.

Flocculators

Each flocculating basin will contain three rows of horizontal shaft, individually driven, flocculators; each drive being located in a dry well at the *center* of the drive shafts. The baffle walls in the basins are arranged so that the water travels parallel to the horizontal flocculator shafts and has twice the linear velocity in the first pass that it has in the second. This is rather an accident of design, but is in keeping with the general opinion that the velocity through a mixing basin should decrease as the reaction becomes more nearly completed.

Clarifiers Have Sludge Thickening Wells

The settling basins will be square with center feed and peripheral take-off. The sludge removal equipment will be driven from a central column and the main rake will have an extension arm which will reach into and clean the corners. In order to produce as thick a sludge as possible, the center of each basin will have a deepened portion and the rakes in this portion will be fitted with steel pickets for more effective sludge thickening. From the center of the basins the thickened sludge will be pumped to the disposal point by means of pressure-type diaphragm pumps of the design used for filter press work. The sludge pumps

General View from Head House
Looking North Across Flocculators No. 1 and No. 2 and Clarifiers No. 1 and No. 2 Toward 1 MG Wash Tank. (All being set down in a flourishing orange grove.)

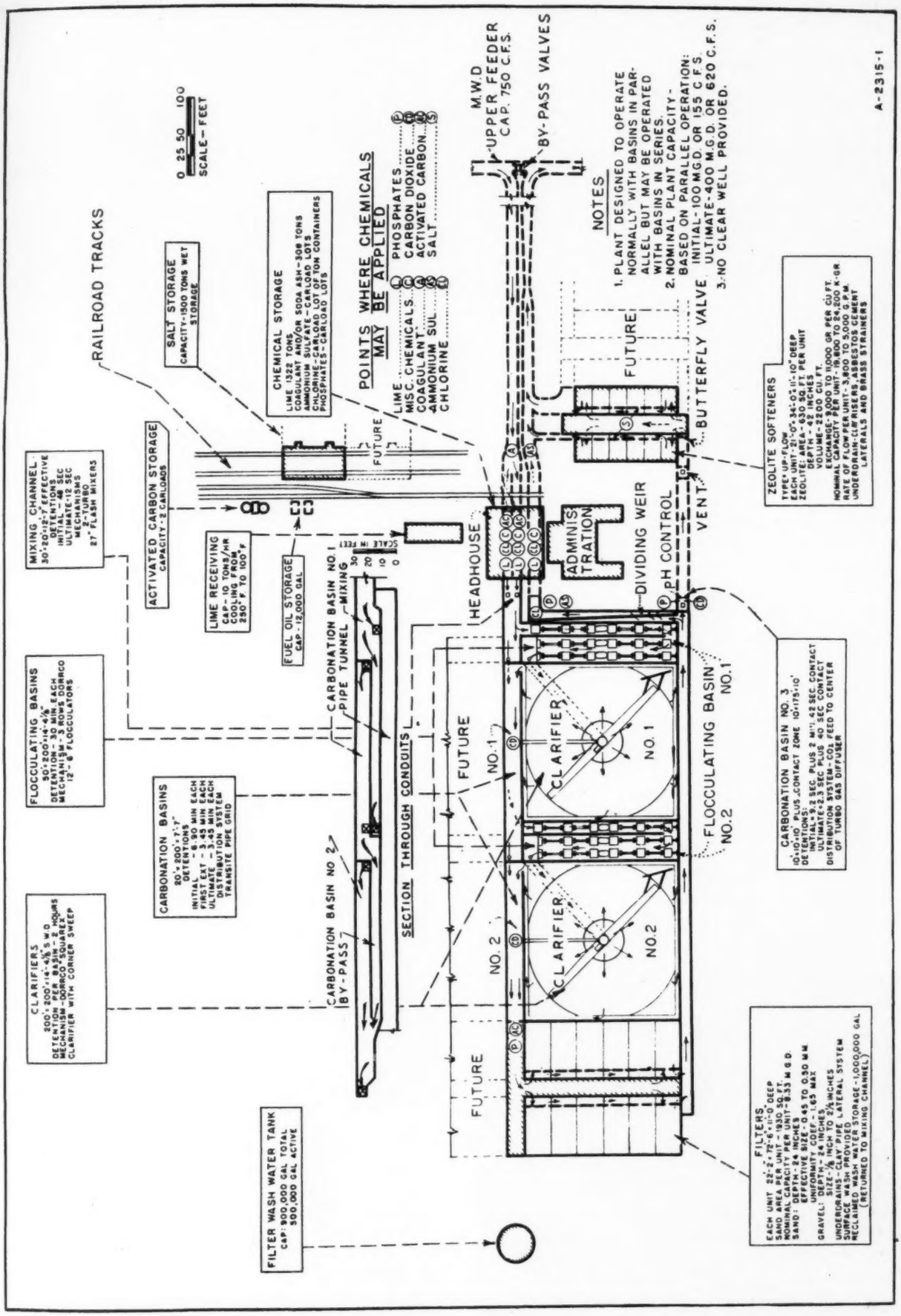

Fig. 1.—Diagrammatic Flow Plan of Plant Revealing Design Data for Various Units

will be located in a room directly under the center cone of the clarifiers, accessible through a tunnel.

Surface Wash for Filters

The filters will be of conventional design with concrete wash troughs, hydraulically operated valves, pipe lateral under drains, individual rate of flow controllers with master control. They are equipped with a lateral surface wash system. Both surface and back wash mains will have wash water rate of flow controllers. Used wash water will be collected in basins beneath the filters and will be returned to the main treated water conduit near the flash mixers. The master control for the effluent rate controllers will automatically maintain the rate of flow through the filters in step with the rate of flow into the plant. Manual means of setting the master control is also being provided.

The lime-softened water from the filters will be divided into two portions. One portion will return to the main aqueduct after having its pH corrected if necessary. The other portion will flow through zeolite softeners where the hardness will be reduced to zero, and thence it will flow back into the aqueduct. Enough water will be softened to zero by this means to reduce the hardness of the entire quantity of water to the desired point. The proportion of the water which will flow to the zeolite softeners will be automatically controlled so that the hardness of the finished water will be kept uniform regardless of fluctuations in the flow of water through the plant.

Up-Flow Zeolite Units

The zeolite softeners will operate up-flow in order to conserve head and wash water, and will be semi-automatic in operation. Manually operated four-way valves on the operating tables will control the opening and closing of the raw water influent and softened water effluent valves. Positive interlocks will be provided which will make it impossible to begin the zeolite regeneration cycle if either or both of these valves are even slightly open. It will also be impossible to open either of these valves if the regeneration process is in progress. It should, therefore, be impossible to get brine into the distribution system through careless operation. After the influent and effluent valves have been closed, the regeneration operation can be initiated by push-button control. Regeneration then proceeds automatically to completion, leaving the softener in readiness to be placed back in operation. Provisions are being made for brine reclamation if such should later be desirable, and the automatic equipment will be so arranged that regeneration can be carried out either with or without the re-use of partially spent brine.

Center Column and Inlet Riser Clarifier No. 2
(Note sludge thickening well at center, directly beneath which are the sludge pumps in a room reached by tunnel.)

The Filters Take Form
Principle Piping in Place Before Wall Pouring.

Brine Economy

The saturated brine from the salt storage tanks will be filtered through a battery of three pressure filters before it is used for regeneration of the zeolite. By filtering the brine, it may be possible to use cheaper grades of salt which might contain appreciable amounts of dirt.

Offices and laboratories will be centralized in the administration building. The laboratories will be well lighted, of ample size, and fully equipped for all kinds of chemical, bacteriological, and biological work, incident to water purification practice. Water samples from all parts of the plant will be available at a central point in the laboratory.

Separate laboratories for research and development work are being provided. New processes and new equipment can be tried out or developed without interference with the normal routine operation of the plant.

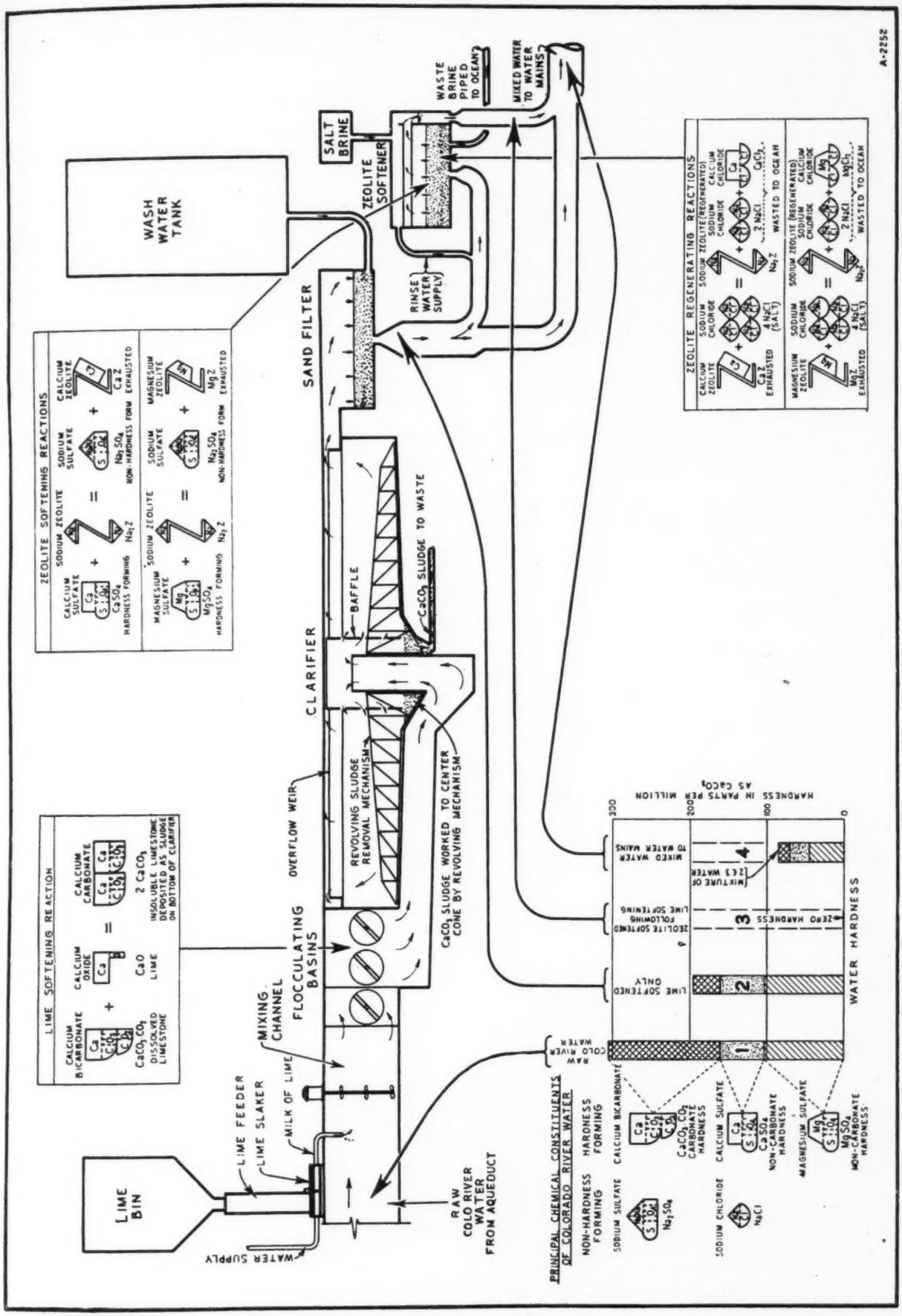

Fig. 2.—Diagrammatic Flow Section Through Plant Revealing Softening Reactions in the Progressive Stages of Treatment

Display and Demonstrations for Visitors

In the administration building there will be a demonstration room seating about 70 people to accommodate groups of students and visitors who will visit the plant. It is expected that from 5,000 to 10,000 people will visit the plant annually. The room will be equipped with facilities for demonstrating, in miniature, the water treatment problems and processes and with a projection booth for showing both sound and silent motion pictures.

The entire administration building and parts of the head house will be air-conditioned. Both temperature and humidity control will be carried out throughout the entire year.

The architectural treatment of the plant has received special attention to achieve an attractive appearance at a minimum cost. It follows modified Spanish colonial lines, with paneled concrete walls and red tile roof. Located in the midst of thousands of acres of orange groves and at the foot of 10,080-foot Mount San Antonio, this plant will prove to be something of a showplace.

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Dallas Now Believed to Have Had Earliest Radio Directed Sewer Service

In our September, 1939, issue an article by Mr. E. P. Decher of Newark, N. J., described what was believed to be the first sewer service truck in the U. S. to be equipped with a radio receiving set, thus permitting direction of activities of the truck and crew by radioed orders from the central office. The N. J. Joint Meeting truck was put in service October 19, 1938, and we, too, assumed it to have been the first radio equipped sewer truck.

In our June issue a brief article told of Cincinnati's *two* radio directed sewer service trucks in service since June, 1939.

Dallas now comes through with a statement which puts this City in the front rank in respect to radio equipped service and supervisory vehicles. The accompanying picture shows Dallas' impressive fleet of 7 radio equipped units of its Water and Sewer Department.

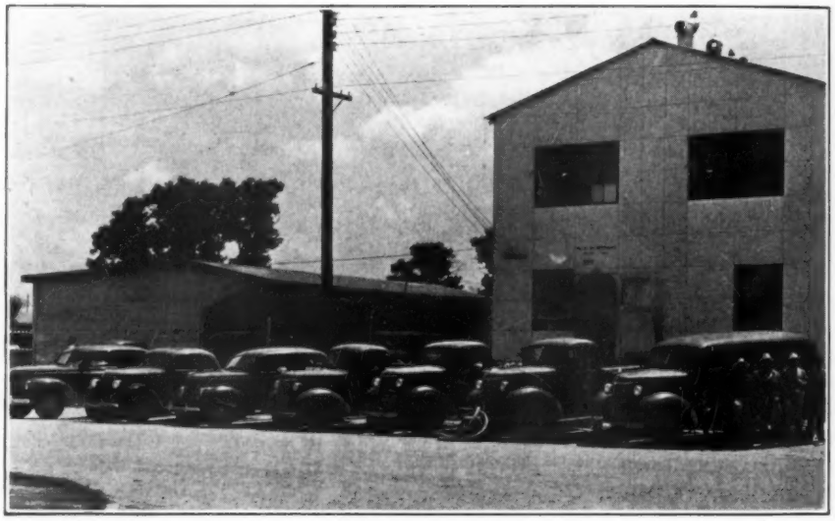
From K. F. Hoefle, Distribution Engineer, comes the following information:

The first service truck to be radio equipped was a sewer truck employed in handling emergency sewer complaints and repairs. It was put in service and assigned a call number on June 14, 1937. Since that date 6 other water and sewerage units have been radio equipped and two more will be added to the fleet during the year.

The accompanying picture shows the fleet as it is today. Starting from the left these units are:

1—Distribution Engineer
2—Asst. Supt. Sewer Maintenance
3—Genl. Maint. Foreman (Oak Cliff Div.)
4—Water Valve Crew (makes all main line shut downs; is called to all main breaks.)
5—Sewer Maint. & Repairs No. 1
6—Sewer Maint. & Repair No. 2
7—*Complaint and Emergency (Sewer)

States Mr. Hoefle: We have been able with this fleet to give almost instantaneous service in emergencies, preventing serious water losses through main failures, in limiting the damage increasing with every minute of delay in water shut off. Likewise, in minimizing hazard to health and property damage by sewer stoppage and flooding. Within the year two more units will join our radio equipped fleet to make of it a 9-unit fleet.



Dallas' Fleet of Radio Equipped Supervision Cars and Service Trucks.

(* The first radio equipped truck—June 14, 1937—was the predecessor of truck No. 7.)

Texas Honor Cities Cited for Sanitation Achievements

The customary annual citations of Texas municipalities by the State Department of Health, naming those which have the best records or which have made the most progress in water supply and sewage treatment, went to the following cities for 1939:

Grossbeck—for the greatest improvements to their Water Treatment Plant.

Huntsville—for the greatest improvements to their Sewage Treatment Plant.

San Marcos—for having consistently maintained the best sewage plant effluent during the year.

SUPER-CHLORINATION*

Some Observations Pertaining to the "Break-Point" and Effects of Components of Natural Waters on the Process

Also a Report on the Cupri-Chloramination Process

By CECIL K. CALVERT
Superintendent of Purification
INDIANAPOLIS WATER CO.
INDIANAPOLIS, IND.

The Author

THE work reported herein was done on White River water at Indianapolis. That laboratory experiments should precede any attempt at application of similar treatment on a plant scale to other supplies, seems proper to emphasize in this first paragraph.

Cupri-chlorination. During the summers of 1937, 1938 and 1939 combinations of copper sulphate, chlorine and ammonia (or ammonium sulphate) have been used to control plankton growth in the large settling basin serving our slow-sand filter plant, operated in parallel with our newer rapid sand plant.

The water going to the slow sand filters enters the basin after having received its coagulant and prechlorination treatment. At the end of the second pass provision was made to apply cupri-chloramination. At this point there has been about 8 hours of retention, and about 36 hours later it leaves the basin and flows to the slow-sand filters. During most of its time in the basin the water is quite clear and the plankton grow rapidly unless inhibitive treatment is employed.

Following the method of Dr. Harold (1) of the London Metropolitan Water Board, 0.3 p.p.m. each of copper sulphate ($CuSO_4.5H_2O$) chlorine (Cl_2) and ammonia (NH_3) were used. This quantity, proving insufficient to control growth, the rate was boosted to 3.0 p.p.m. which was reduced thereafter as conditions warranted. Rafter counts and determination of residual copper, ammonia and chlorine were made (at least daily) at several points through the basin.

Results and Conclusions

So many changing factors affect results that general averages mean nothing. However, a study of laboratory and operating results leads to these generalizations.

(1) Copper, chlorine and ammonia are all useful in plankton control, the former being more generally effective. At least one diatom, Achnanthes, resists more than a part per million of copper sulphate, but is unable to grow in the presence of as little as 0.25 p.p.m. of chlorine. On the other hand, an unidentified filamentous organism withstood 4 p.p.m. of chlorine, applied when the water had a demand of about 3 p.p.m., but was eliminated by 2 p.p.m. of copper sulphate.,

(2) No virtue has been found in a combination of the three chemicals, except when the kinds of organisms present indicate the need for all three. The presence of ammonia, either anhydrous or as the sulphate, seems to have no ability to reduce the copper precipitation effect observed in this water, having an alkalinity of about 250 p.p.m. Neither does chlorine seem to extend the solubility of copper.

(3) On the basis of daily microscopical examinations, a suitable rate of copper and chlorine treatment may be applied. No ammonia need be applied for the formation of cupric ammonium. Ammonia may be needed to form chloramine if such an effect is desired. Otherwise ammonia is undesirable, because it is a bacterial food and creates subsequent biological growths and resultant odors in distant parts of the system. This happens, even though the slow filters change it to nitrates. The slow filters remove most of the copper remaining in the settled water.

(4) Sunlight rapidly dissipates even the chloramines. Large chlorine excess is needed to carry a water through a bright day if aftergrowth is to be prevented. The so-called "break-point" in chlorine demand may need to be exceeded. This brings us to the chief topic to be discussed.

What Is This Chlorine "Break-Point"?

Because in alkaline and acidified portions different amounts of residual chlorine are recorded when titrating waters containing so-called "free ammonia," we suspected that nitrogenous compounds would be found to be involved intimately in the phenomenon now called "break-point" chlorination. This, however, is seemingly nothing new. In 1922 Howard (2) used the ammonia content of the Toronto raw water to show the need for changes in chlorine dosages applied in super-chlorination of the Toronto supply.

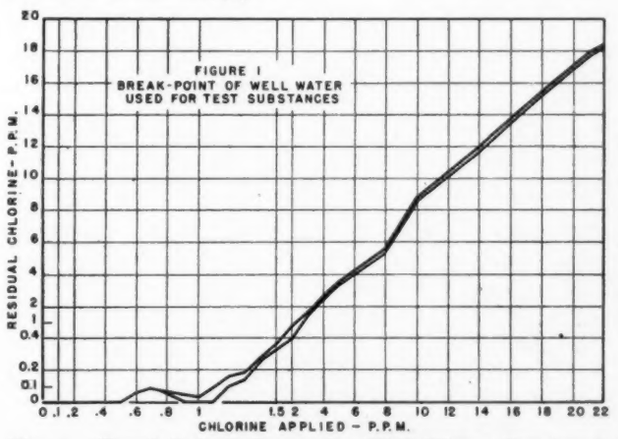


Fig. 1—"Break-Point" Curve On Well Water Employed in Super-Chlorination Studies

(*It was chosen as the purest natural water located for the work.*)

*A paper read before the 60th Annual Convention of the American Water Works Association, and here presented by permission of the Association.

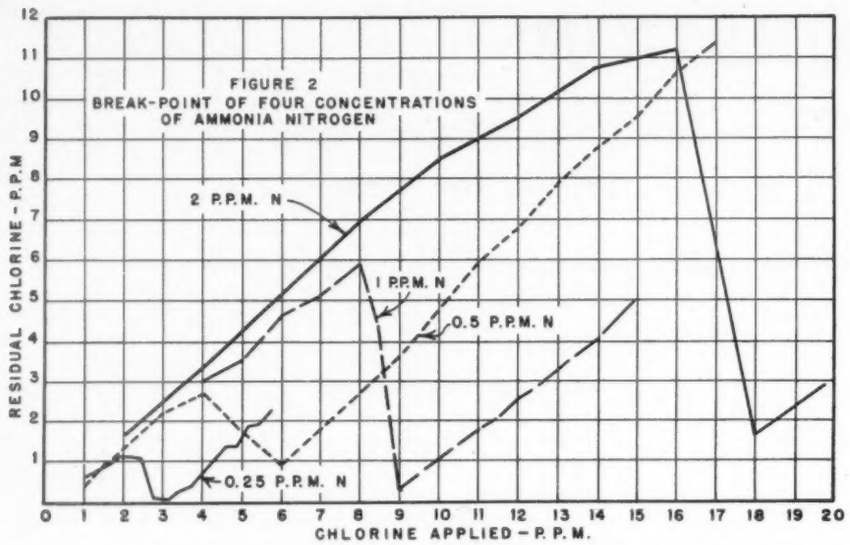


Fig. 2—Curves Revealing the Effects of Various Concentrations of So-Called Free Ammonia (NH_4Cl) on the "Break-Point" Curve

"Break-Point" and Shape of Chlorine Demand Curves

To study the effect of definite substances on the location of the break-point and the shape of the chlorine residual curve, a well water was used that exhibited a break-point of 1 p.p.m. (Fig. 1). Much of the assimilated chlorine was apparently used by mineral substances. This water was employed in making the studies. The first involved varying the ammonia content only.

The location of the break point has been found to be very nearly in direct proportion to the free ammonia in the water under test. (Fig. 2). The results are shown for ammonia (N) concentrations from 0.25 p.p.m. to 2.0 p.p.m.

The next series of tests (Fig. 3) revealed that such nitrogenous materials as egg albumin and gelatin show no break-point and very low chlorine assimilation; and tryptose and peptone produced curves with no large initial rise, but a rather low residual persists followed by a slow rise beyond what might be expected to be a break point.

On the other hand simple ammonium chloride forms a spectacular curve (Fig. 3). A large initial rise in residual chlorine precedes a sudden pronounced drop to a break-point which is followed by a rapid increase. An extremely interesting and significant observation was that tests made for residual free ammonia showed none remained at the break-point.

Amino acetic acid exhibits the same rapid initial rise in residual. But, the break-point may be termed slow or "lazy" (Fig. 3) and is followed by a long span during which the "chlorine thirst" of the compound is being satisfied. When this is over the build up of residual at a slow rate is observed. This amino compound gives no color with Nessler's solution. But, after the addition of chlorine ammonia is found —and, in an amount which accounts for the whole of the nitrogen in the amino acid added. Then, again, no free ammonia is to be found when the break-point is reached.

The ratio of nitrogen present as free ammonia in the original sample to the chlorine *assimilated* at the break-point is 1:7.5. This is substantially the nitrogen-chlorine ratio of nitrogen trichloride (NCl_3), the odor of which is present in samples treated beyond a high break point. This, in the face of the fact that nitrogen trichloride is not supposed to form in a medium which is neutral or alkaline . In raw water and in some well waters the nitrogen-chlorine ratio was found to vary from 1:7.5 to 1:20 or more, indicating that other substances than simple forms of nitrogen have been reacted on by the excess chlorine in the zone of the break-point.

Neither the residual found in alkaline or acid titrations (Fig. 4) while still on the left of the break point will combine quickly with nitrite. On the other hand both forms of residual do so on the right of it. The McNamee amine test (3) is positive on the left and negative on the right of the break-point.

Free ammonia nitrogen results, by direct Nesseleriza-

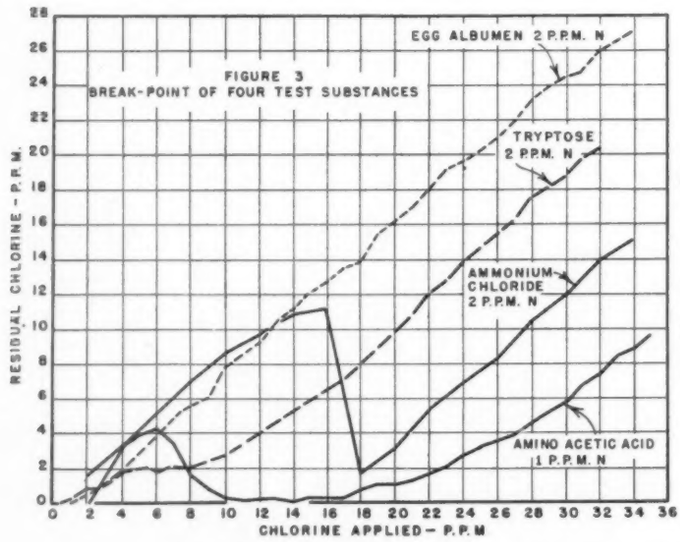


FIGURE 3
BREAK-POINT OF FOUR TEST SUBSTANCES
EGG ALBUMEN 2 P.P.M. N
TRYPTOSE 2 P.P.M. N
AMMONIUM CHLORIDE 2 P.P.M. N
AMINO ACETIC ACID 1 P.P.M. N
RESIDUAL CHLORINE - P.P.M.
CHLORINE APPLIED - P.P.M.

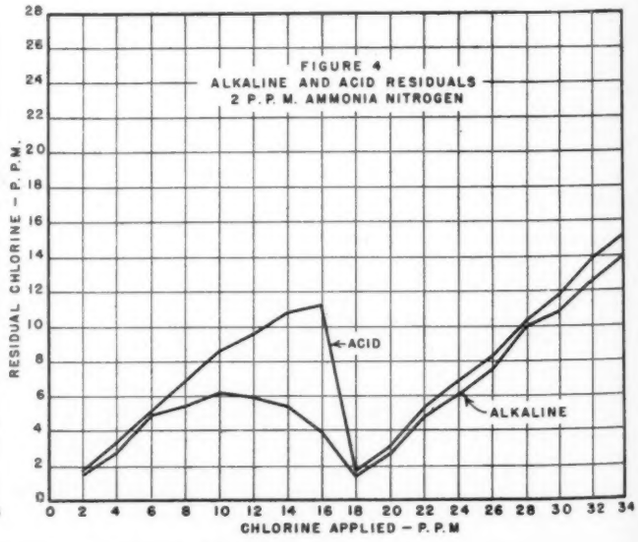


Fig. 3—Comparison of the Effect of Various Nitrogenous Compounds on the "Break Point" Curve

Fig. 4—Comparative Residual Chlorine Return Up-to and Beyond the "Break Point" on Water Containing High Ammonia Nitrogen

(Titration by Starch Iodide Method in Neutral vs. Acidified Portions of the Same Sample.)

tion, are increased when dechlorination is effected with thiosulphate. To a lesser extent, the same is observed when employing bisulphite. Ferrous sulphate may remove a little of the ammonia. Nitrates (determined by the reduction method) are affected also.

In chlorinated samples treated well beyond the break-point, direct Nesselerization of the dechlorinated water develops true amomnia color, but in small amount. High chlorine residuals will give a color similar to nitrite when sulphanilic acid is added first. But a yellow color develops if the alphanapthilamine reagent is added first. These analytical interferences complicate a study of the reactions between chlorine and nitrogen.

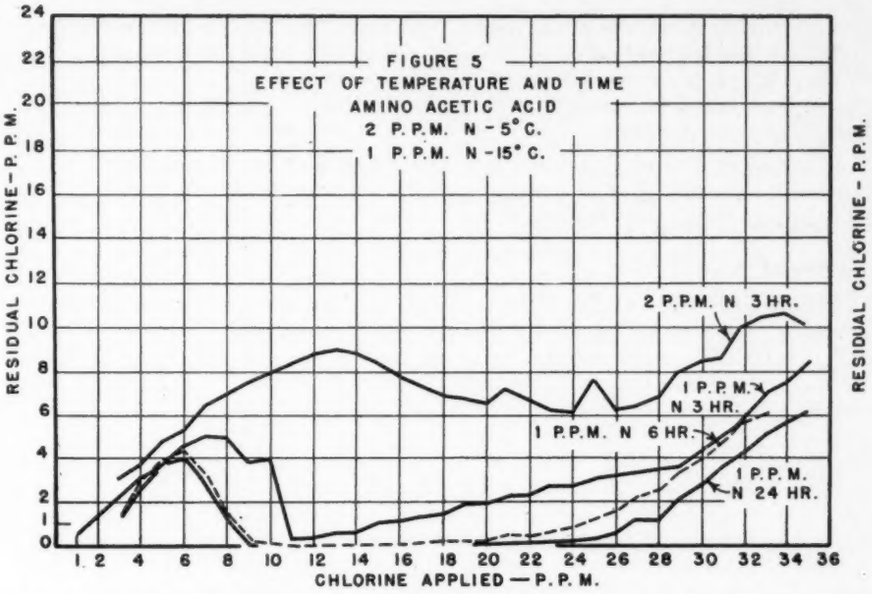


FIGURE 5
EFFECT OF TEMPERATURE AND TIME
AMINO ACETIC ACID
2 P.P.M. N - 5° C.
1 P.P.M. N - 15° C.
RESIDUAL CHLORINE - P.P.M.
2 P.P.M. N 3 HR.
1 P.P.M. N 3 HR.
1 P.P.M. N 6 HR.
1 P.P.M. N 24 HR.
CHLORINE APPLIED — P.P.M.

Fig. 5—Effect of Temperature and Contact Period on the Pattern of "Break Point" Curves on Water Containing Amino Nitrogen

Effect of Temperature and Time on Curve Patterns

As in any other chemical reaction, temperature is an important item in the super-chlorination effect. The low temperature (5°C.) obtaining during test produced the upper line in Fig. 5, showing no definite break point. Then, in a subsequent experiment an increase of only 10°C. (to 15°C.) resulted in a positive break-point and the long valley noted in the lower lines, even at 3 hours contact—see Fig. 5. Especially in dilute solutions, time is an important factor in the completion of reaction.

The lower lines in Fig. 5 represent titrations of portions of the same samples at 3, 6 and 24 hours following the several chlorine dosages. The 3 hour contact time gave no suggestion that the reaction was incomplete. The six hour contact time not only extended the low residual chlorine zone, but gave indication of a further change to come which was found at the end of 24 hours and which extended the low chlorine zone over a still wider range of chlorine dosage. Even at the end of 24 hours there is a slight break in the rising line beyond the low zone. This may indicate a further extension of reaction.

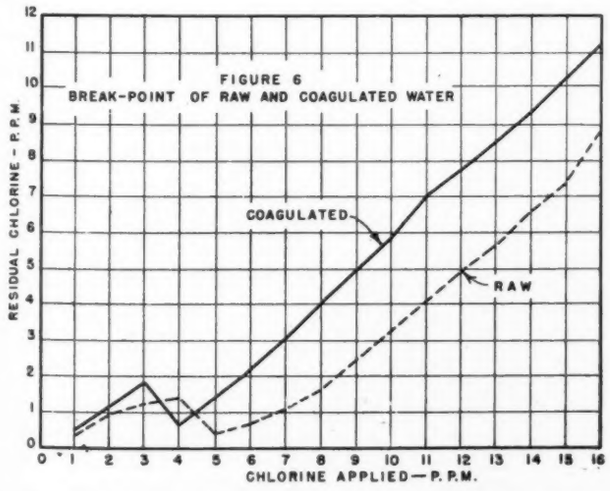


Fig. 6—A Study of Chlorine Demand and "Break Point" Curves for Coagulated vs. Raw Water.
(*In this instance only* 1 *ppm. difference in chlorine required.*)

Effect of Coagulation on "Break-Point" Demand

The laboratory coagulation of raw water (turbidity = 260 p.p.m.; alum dosage, 500 lbs. per m.g.) reduced the total organic nitrogen from 1.76 p.p.m. to 0.81 p.p.m., whereas the free ammonia (N) remained unchanged at 0.35 p.p.m. Coagulation reduced the break-point chlorine demand by only one part per million (Fig. 6), but the shape of the rising curve beyond the break point of the uncoagulated water (Fig. 6) is noticably flatter. It is not surprising that the cogulable matter consumes chlorine even beyond the break point, and it is noted that the residual ahead of the break-point lags somewhat.

Chlorination after coagulation saves some chlorine but in most plants the time remaining after sedimentation is too short to permit completion of the effective reactions, especially at low temperatures. The high chlorination of the raw water at Indianapolis suppressed completely the odor of the deposited sludge in the settling basin this winter, and reduced it decidedly last summer. It is well to remember that decomposition of sludge adds odor to water passing over it. So long as the pH is not affected seriously, high chlorine rates do not interfere with coagulation and may be a help.

Taste and Odor

A number of odors associated with sewage pollution are destroyed at the break-point even though they may be accentuated when employing lower chlorine rates. Even with high chlorine dosage there may be a "musty" or "river" or "woody" odor remaining which economical amounts of carbon will remove. It may be applied after the chlorine effect is completed and, in some cases, with the chlorine. If the ammonia content be sufficiently low the very objectionable chlorophenol can be destroyed with very small doses of chlorine—(Fig. 7). In the absence of NH_3 the odor produced by both 10 and 50 p.p.b. of phenol disappears with the use of 1 p.p.m. of active chlorine. When ammonia is present, chlorophenol odor is present ahead of the break-point and absent when the break-point is reached—(Fig. 7).

Some odors of biological origin are much more of a problem. For instance, Synura odor is destroyed only after passing the break-point, the amount of excess chlo-

rine required above the break-point dosage being governed by the concentration of the odorous substance. With a break point at 3.0 p.p.m. a chlorine rate of 5 p.p.m. was required under Indianapolis conditions and low temperature water.

It is believed most tastes are not destroyed until the ammonia-chlorine reaction is completed. Or we may say, at least not completely destroyed.

Bacterial Kill

Even in raw water with 3.0 p.p.m. of free ammonia nitrogen, 1 p.p.m. of applied chlorine usually will kill coliforms within three hours. Most of the bacteria in raw water are killed with the application of rather small chlorine doses but there seems to be a high rate of multiplication of some species of bacteria which we find sporadically in portions treated well beyond the break-point in every series examined. (See Figs. 8, 9 and 10.) There must be a reason for them and it is being sought. Only spore forming bacteria have been recovered from samples receiving chlorine dosages in the break-point zone. That some of the residual organisms are gas formers is not surprising. In coagulated water which has been effectively flocculated small chlorine doses result in almost complete bacterial kill and gas formers are generally absent in 100 ml. portions. (Fig. 11.) In raw water the bacteria are seemingly more protected against chlorine attack by the coagulable materials present. Others, removable by coagulation may by nature possess their own protective coverings. This may be simply another demonstration of the oft repeated evidence that the chlorination of turbid waters, that is, water containing gross solid particles is not always effective. It is not beyond reason to consider that the effect of chlorine on organic particles may be such as to release once embedded colonies into the dechlorinated water, where multiplication can proceed unhampered by the natural enemies of such organisms.

[Investigators should also look to the absolute sterility of the dechlorinating solutions and methods of handling. Our experience has indicated this rather pointedly, but the other possible explanations sound quite valid.—ED.]

"Break-Point" Treatment and Water Quality

The weather in the vicinity of Indianapolis during the first 3 months in 1936 and 1940 was similar. In 1936 pre-chlorination was at about 5 lbs. per m.g. and this year (1940) it ranged from 35 lbs. to a maximum of 175 lbs. per mg.

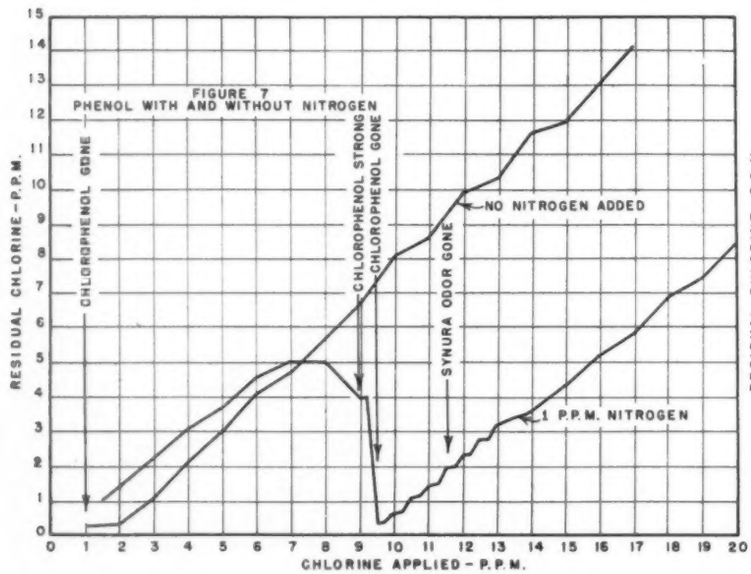
In 1936 about 90 per cent of the 10 ml. portions of settled water contained gas formers and 4 per cent confirmed. In 1940 less than 30 per cent contained gas formers and 0.3 per cent confirmed. However, the plant effluent contained no coliforms in 100 ml. in either year. The color of the finished water in 1936 was 10 p.p.m. and in 1940 it was only 4 p.p.m., the color produced by high chlorine rates being removed easily in coagulation and filtration.

The lower rate of pre-chlorine treatment (4.2 p.p.m.) was sufficient to reduce the significant organisms to a point much below that required for even finished water. The reduction in color is unimportant since 10 p.p.m. is unobjectionable. Methods of recording taste are inexact and comparison is difficult but it is believed that the finished water in 1940 was superior to that in 1936 with respect to taste and odor. The cost of the carbon used in 1936 was about the same as the chlorine cost in 1940.

Method of "Break-Point" Control

The simplest means of break-point chlorine control, for many waters at least, is the Laux method (5) which takes advantage of the difference in speed of color development by orthotolodin. The truly active chlorine produces speedy color development, while the sluggish partially bound chlorine is slow to develop color. At the left of the break-point (Fig. 4), color development is slow, whereas, at the break-point and to the right of it, the color comes quickly and reaches its maximum almost at once. [It should then hold this maximum for a half hour at least, if not in sunlight.—ED.]

The unreliability of orthotolodin for the control of residual chlorine in finished water resulted in the substitution of the iodimetric method at Indianapolis more than a year ago. While the method is more cumbersome it is more accurate and it may be used to show active



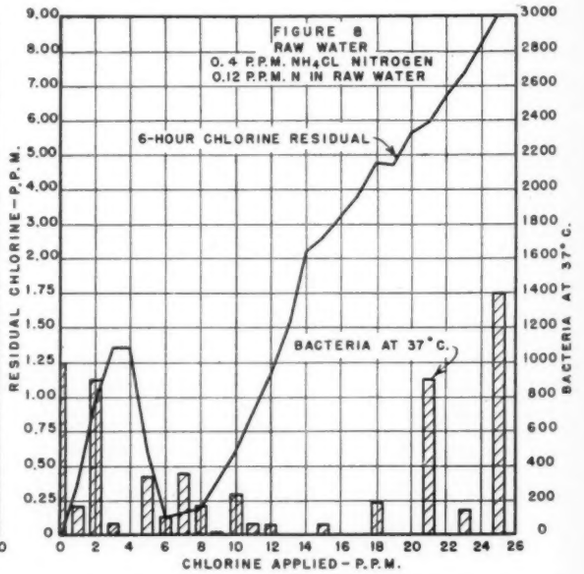
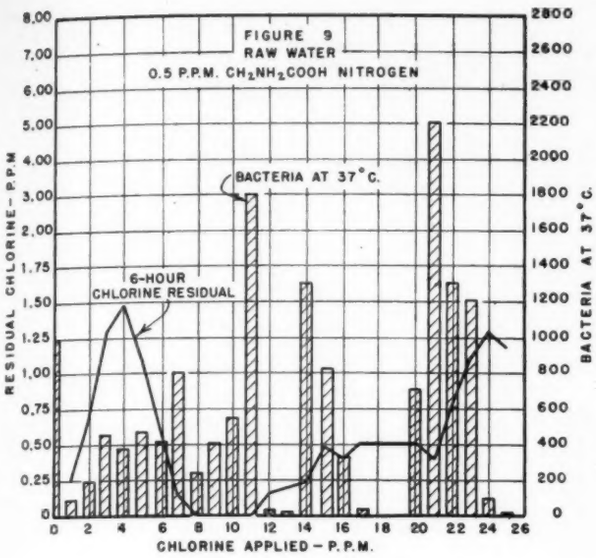


Fig. 7—Curves Revealing the Significant Effect of Ammonia on the "Break Point" Pattern and Chlorine Required to Effectively Destroy Phenolic or Algae Odors

Fig. 8—Correlation Between the "Break Point," Chlorine Residuals, Bacterial Kill and Re-growth of Organisms Sometimes Noted



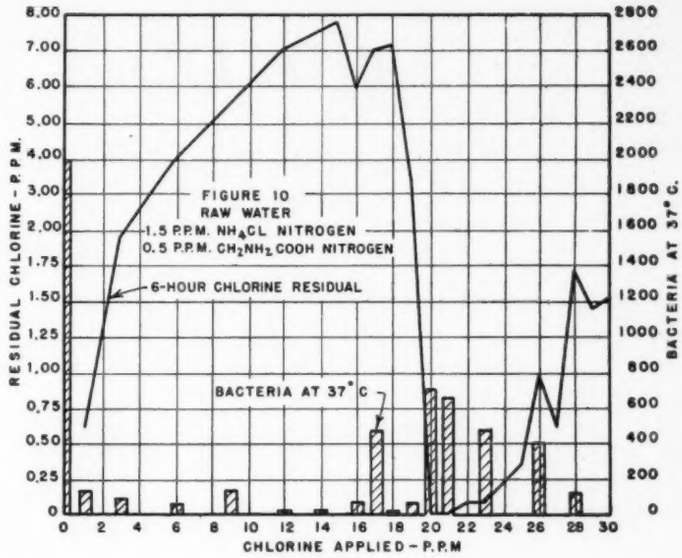


Fig. 9—Graph Revealing the Effect of Amino Acid on the Residual Curve and Re-growth of Organisms

Fig. 10—Effect of a Combination of Ammonia and Amino Nitrogen on the Residual Curve and Re-growth of Bacteria

and inactive chlorine (alkaline vs. acid titrations) and, consequently, the position of the break-point.

A sample falling to the left of the break-point, titrated without the addition of acid shows a much lower chlorine content than when acid is present. The upper line (Fig. 4) is the chlorine found by adding acid in the titration and the lower shows that found with no acid added. At and beyond the break-point the two titrations are nearly alike (Fig. 4).

In plant control the titration of samples of treated water will show the position of chlorine dosage employed in respect to the break-point—i.e. to left or to right of the break in the residual curve. In case of doubt, the sample may be heated to 43°C. for ten minutes before the additions of reagents. If no residual chlorine remains, the break-point is close to the dosage employed. If acidification releases no additional chlorine after the alkaline titration, the break-point is passed. If no chlorine is released without acid but is released with acid, the break-point has not been reached.

The assistance of the Chief Chemist, Neil Kershaw and his assistant, E. R. Hupp, of the Plant Engineer, M. P. Crabill, and of D. E. Bloodgood, Superintendent of the Indianapolis Sewage Treatment Plant is appreciatively acknowledged.

[Note: In speaking of sewage, we were considerably interested in Mr. Calvert's findings concerning the differential in returns of residual chlorine, when titrating in the neutral (or slightly alkaline) and when acidifying. This condition has long been observed on chlorinated sewages, on heavily polluted stream waters, and some swimming pool waters. It has not come to light before in connection with chlorination of potable waters. There is a distinct correlation between the neutral-acid titration differential and the lag noted in speed of maximum color development in the ortho-tolidin test. Increasing the acidity of the ortho-tolidin reagent increases the speed of color developments in sewages and many pool waters. Our experience indicates that the neutral-acid differential may be exceedingly slight for most waters, but the more severe the pollution the more useful will prove this differential index of what Super-chlorinator Alexander of California has termed the "Stable Residual"—i.e. that residual which is no longer undergoing assimilation by components of the chlorinated liquid—or, at least is being very slowly assimilated.

Mr. Calvert and his staff at Indianapolis were the first to announce the "break-point" in super-chlorination practice and their extended work since warrants the highest praise.—L. H. ENSLOW.]

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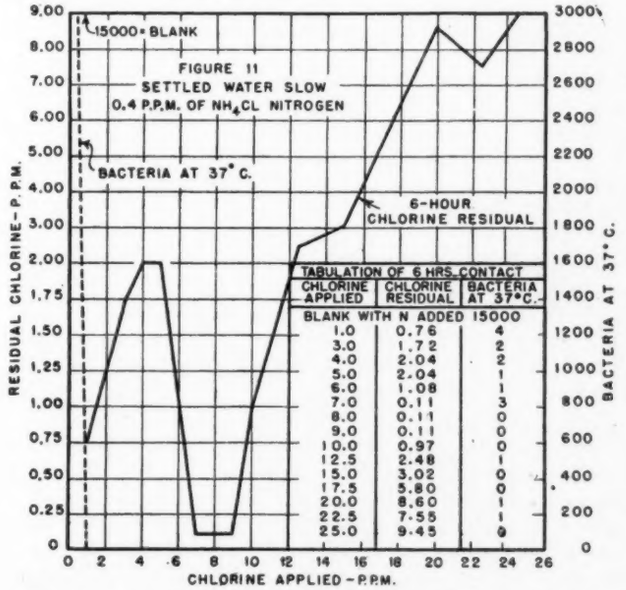
15000+ BLANK
FIGURE 11
SETTLED WATER SLOW
0.4 P.P.M. OF NH_4CL NITROGEN
BACTERIA AT 37°C.
6-HOUR
CHLORINE RESIDUAL
TABULATION OF 6 HRS. CONTACT
CHLORINE APPLIED | CHLORINE RESIDUAL | BACTERIA AT 37°C.
BLANK WITH N ADDED 15000
1.0 | 0.76 | 4
3.0 | 1.72 | 2
4.0 | 2.04 | 2
5.0 | 2.04 | 1
6.0 | 1.08 | 1
7.0 | 0.11 | 3
8.0 | 0.11 | 0
9.0 | 0.11 | 0
10.0 | 0.97 | 0
12.5 | 2.48 | 1
15.0 | 3.02 | 0
17.5 | 5.80 | 0
20.0 | 8.60 | 1
22.5 | 7.55 | 1
25.0 | 9.45 | 0
RESIDUAL CHLORINE - P.P.M.
BACTERIA AT 37°C.
CHLORINE APPLIED - P.P.M.

Fig. 11—Graph Picturing the Absence of Re-growth of Organisms in Indianapolis Water Effectively Coagulated and Chlorinated

THE COST OF MAINS

An Attempt at Deriving a Useful Estimating Guide

By D. R. TAYLOR
Plant Superintendent
ROANOKE WATER DEPARTMENT
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AMONGST the vicissitudes and pleasures of life and the progress of industry and commerce, prognostication continues to be increasingly interesting to most of us. As time goes on, our material and cost estimates, like mathematical formulæ involving infinity, continue to approach something that they may never actually reach—namely, factual perfection.

Even the average life span of such an everyday thing as cast-iron pipe is still a matter of conjecture. Authentic records of the earliest cast-iron pipe still in service include that supplying water to a fountain at Langensalza, Germany, which was laid prior to 1562, and cast-iron pipes are still supplying the fountains of Versailles, France, after 276 years of service. There are many records going back over 150 years in England and more than 100 years in this country. Such records as these have often been the cause of much difference of opinion among engineers in the appraisal of the net worth of water plants.

Estimating the Cost of Mains and Extensions

The accompanying tabulation has been prepared by the writer for use as a handy reference in estimating. It is based on the average cost of mains under an average group of conditions and methods. Considering that each of the sixty-six items making up the aggregate vary according to varying conditions and methods, it may be easily appreciated that, any number of combinations of these items may influence the end result in accurate estimating.

Some of the items shown may be performed at a lower cost than indicated, while others may cost more. As a matter of fact, methods and costs will undoubtedly vary between jobs in the same locality; however, the fact remains that an estimate is necessarily based on an average of as many representative jobs as can be reviewed at the moment.

"Doc" Taylor

While there are many very reliable records of total costs of mains, it is surprising what little information can be obtained relative to the man hours and equipment hours required to perform the individual items comprising the total job.

Applying Correction Factors

These man and equipment hour units are shown for the more variable items to enable anyone to calculate an estimate of his costs by substituting his prevailing labor and equipment prices in deriving required correction factors. It is, of course, understood that prices of materials will vary between times and places, especially cast-iron pipe, and it is assumed that quotations on these will be obtained in each specific instance, and a correction factor derived for application.

In the case of cast iron pipe of sizes 30 inches and larger, the manufacturers will send their representatives to inspect the site of the proposed project and design lighter but higher tensile strength pipe to suit the particular conditions such as depth of cover and weight and intensity of traffic. Such pipe now obtainable through modern methods can be furnished at prices materially less than that of "standard" pipes specified and used in former years.

As time goes on and more records and improved equipment become available, undoubtedly modifications and adjustments will be suggested. In the meantime, accumulating cost records should be extremely interesting and the accompanying table should serve a useful purpose in arriving at more dependable cost data in water main construction, which will be highly useful in setting up estimates.

Note:—This tabulation of estimating data constitutes a material amplification of an earlier tabulation used by Mr. Taylor and reproduced in the 1940 *Reference and Data Number of this magazine. In his successful attempt to better the original tabulations the following excerpts from "Doc" Taylor's letter are significant.*

"During the last two years I have talked with a great many contractors, engineers and water works operators and have been surprised to learn that none of them knew the unit man and equipment hours required to perform the various items in laying mains.

During the last year we have been doing some unit accounting in all of our construction and maintenance work in an effort to determine these units, with the idea of making a tabulation with which any operator in any city or town could substitute his labor and equipment costs and calculate an estimate of the cost of mains. In addition to this, I wrote the pipe manufacturers for such information as they might have. Such proved to be practically nothing.

In discussing the matter and exchanging experiences with others, they said if I succeeded in working out a tabulation of units, that it would be a real contribution.

Considering this a challenge, I began collecting information from equipment manufacturers, our records, the records of the city street repair department and state W.P.A. records, and slipped a slide rule at night and during week-ends for the last ninety days, and wound up with the enclosed tabulation, which may not be perfect by any means, but at any rate it is a start and the only thing of its kind that I know of in this country."

Yours sincerely,

"Doc."

ESTIMATE OF COST OF MAINS PER FOOT

	GALVANIZED			CAST IRON											
1 Size of main	1″	1½″	2″	2″	4″	6″	8″	10″	12″	16″	18″	20″	24″	30″	36″
2 Trench-width	18″	18″	18″	20″	20″	20″	22″	24″	26″	30″	34″	36″	41″	46″	52″
3 depth	38″	38″	39″	40″	48″	52″	54″	56″	58″	64″	68″	71″	77″	86″	93″
4 Cover over bells	37″	37″	37″	36″	40″	41″	41″	41″	41″	42″	44″	44″	46″	48″	48″
5 MATERIALS—plus 1% for waste															
6 Pipe (cast iron F.O.B. siding)	.12	.14	.18	.26	.55	.80	1.13	1.52	1.95	2.99	3.60	4.20	5.60	7.83	10.67
7 Add-for cement lining				.02	.04	.07	.10	.13	.17	.19	.23	.26	.35	.40	.55
8 Add-for bitumastic lining				.03	.06	.08	.12	.16	.21	.24	.29	.34	.45	.64	.87
9 Haul pipe—up to one mile															
10 Crane & operator-hrs. per 100 ft. (one at ea. end of haul)											2.34	2.68	3.12	3.75	4.16
11 Truck & driver-hrs. per 100 ft. (two of each)				.184	.430	.750	1.140	1.560	2.040	3.120	2.34	2.68	3.12	3.75	4.16
12 Man hours per 100 feet				.750	1.700	3.000	4.600	6.300	8.400	12.500	4.68	5.36	6.24	7.50	8.32
13 COST—Crane & operator at $3.00 per hr											.0702	.0804	.0936	.1125	.1248
14 —Truck & driver at $0.75 per hr				.0014	.0032	.0056	.0086	.0117	.0153	.0234	.0176	.0201	.0234	.0281	.0312
15 —Labor at $0.38 per hr				.0029	.0065	.0114	.0175	.0240	.0320	.0475	.0178	.0204	.0237	.0285	.0316
16 Add 2% to lines 13, 14, & 15 for each extra mile															
17 Joint compound at $0.12 per pound					.0220	.0330	.0440	.0550	.0660	.0907	.1017	.1155	.1430	.1760	.2090
18 Braided hemp at $0.20 per pound					.0017	.0025	.0032	.0037	.0044	.0057	.0064	.0070	.0082	.0200	.0241
19 PAVEMENT—square yards per linear foot	.1666	.1666	.1666	.1855	.1855	.1855	.2032	.2222	.2400	.2780	.3142	.3332	.3800	.4260	.4830
20 Removal-compressor & two paving breakers															
21 Asphalt 8″—Equipment at 20 sq. yds. & $0.85 per hr	.0071	.0071	.0071	.0079	.0079	.0079	.0086	.0095	.0102	.0118	.0134	.0142	.0162	.0181	.0205
22 —Labor at 2. 5 sq. yds. & $0.38 per hr	.0253	.0253	.0253	.0282	.0282	.0282	.0309	.0338	.0365	.0423	.0478	.0507	.0578	.0648	.0735
23 Concrete 8″—Equipment at 5.0 sq. yds. & $0.85 per hr	.0283	.0283	.0283	.0315	.0315	.0315	.0346	.0378	.0408	.0473	.0535	.0566	.0646	.0724	.0821
24 —Labor at 1.25 sq. yds. & $0.38 per hr	.0533	.0533	.0533	.0594	.0594	.0594	.0651	.0712	.0767	.0890	.1008	.1066	.1215	.1362	.1542
25 Brick on 6″ concrete—Equip. at 4.0 sq. yds. & $0.85 per hr.	.0353	.0353	.0353	.0393	.0393	.0393	.0431	.0472	.0508	.0590	.0667	.0706	.0805	.0902	.1022
26 —Labor at 1.0 sq. yds. & $0.38 per hr.	.0633	.0633	.0633	.0705	.0705	.0705	.0772	.0845	.0912	.1058	.1095	.1268	.1442	.1620	.1835
27 EXCAVATION—cubic yards per linear foot															
28 Entire depth	.1760	.1760	.1810	.2060	.2470	.2680	.3050	.3460	.3880	.4950	.5930	.6600	.8150	1.0200	1.2400
29 Under 8″ asphalt or concrete	.1390	.1390	.1440	.1650	.2060	.2270	.2600	.2960	.3350	.4330	.5230	.5860	.7300	.9250	1.1330
30 Under brick on 6″ concrete	.1252	.1252	.1302	.1493	.1903	.2113	.2428	.2780	.3146	.4100	.4970	.5580	.6985	.8900	1.0925
31 COST—by hand at .375 cu. yds. & $0.38 per hr															
32 Line 28—earth	.1782	.1782	.1835	.2087	.2501	.2718	.3090	.3509	.3930	.5020	.6010	.6690	.8260	1.0340	1.2580
33 Line 29—earth	.1410	.1410	.1460	.1672	.2088	.2300	.2635	.3000	.3399	.4380	.5300	.5940	.7400	.9370	1.1500
34 Line 30—earth	.1270	.1270	.1320	.1514	.1930	.2140	.2460	.2820	.3190	.4160	.5040	.5660	.7080	.9020	1.1090
35 Medium soft shale at $2.25 per cubic yard (line 28)	.3960	.3960	.4075	.4640	.5560	.6030	.6860	.7780	.8730	1.1140	1.3340	1.4860	1.8340	2.2940	2.7900
36 COST—by machine, operator, helper, & three laborers at 25															
37 cu. yds. & $7.60 per hr															
38 Line 28—earth only or earth & asphalt	.0535	.0535	.0550	.0626	.0751	.0815	.0927	.1051	.1180	.1502	.1801	.2008	.2478	.3100	.3770
39 Line 29 & 30 after concrete & brick removed	.0423	.0423	.0437	.0502	.0626	.0690	.0790	.0900	.1019	.1315	.1590	.1780	.2220	.2810	.3444
40 Hard rock-equipment, materials & labor at 0.5 cu. yds. &															
41 $1.60 per hr. (line 28)	.5630	.5630	.5780	.6590	.7900	.8570	.9760	1.1080	1.2410	1.5820	1.8980	2.1100	2.6100	3.2600	3.9680
42 Add for bracing-to lines 32, 33, 34, 33 & 39									.09	.10	.11	.12	.13	.14	.15
43 LAY PIPE—crane & operator-hrs. per 100 feet											2.78	3.46	3.88	4.30	4.68
44 —man hours per 100 feet	5.270	5.270	5.270	5.270	18.40	23.70	26.30	31.60	36.80	44.70	19.50	24.20	27.20	30.10	32.80
45 COST—crane & operator at $3.00 per hr											.0834	.1038	.1164	.1290	.1408
46 —labor at $0.38 per hr	.020	.020	.020	.020	.070	.090	.100	.120	.140	.170	.0742	.0920	.1032	.1188	.1245
47 BACKFILL—entire depth—cubic yards per foot	.1584	.1584	.1629	.1854	.2223	.2412	.2745	.3114	.3492	.4340	.5160	.5660	.6800	.8100	.9470
48 COST—by hand at 1.0 cu. yd. & $0.38 per hr	.0602	.0602	.0618	.0705	.0845	.0916	.1042	.1182	.1328	.1650	.1960	.2150	.2582	.3080	.3220
49 —by machine, operator & four laborers															
50 —at 25 cu. yds. & $3.52 per hr	.0223	.0230	.0229	.0262	.0314	.0340	.0387	.0439	.0493	.0612	.0727	.0798	.0960	.1142	.1335
51 TAMPING—by hand at 0.666 cu. yds.&$0.38 per hr. (line 47)	.0905	.0905	.0928	.1058	.1270	.1375	.1565	.1775	.1990	.2472	.2940	.3228	.3880	.4620	.5400
52 —by machine—one compressor & five tampers															
53 —equipment at 10 cu. yds. & $0.85 per hr	.0135	.0135	.0138	.0158	.0189	.0205	.0234	.0264	.0297	.0369	.0438	.0481	.0578	.0688	.0720
54 —labor & 2.0 cu. yds. & $0.38 per hr	.0301	.0301	.0309	.0352	.0423	.0458	.0522	.0592	.0664	.0825	.0980	.1075	.1292	.1540	.1800
55 SURPLUS—cubic yards per linear foot	.0176	.0176	.0181	.0206	.0247	.0268	.0305	.0346	.0388	.0610	.0770	.0940	.1350	.2100	.2930
56 COST of disposal at $0.75 per cu. yd	.0132	.0132	.0136	.0155	.0186	.0206	.0229	.0260	.0291	.0457	.0577	.0705	.1012	.1575	.2200
57 PAVEMENT—cost of restoration (line 19)															
58 Asphalt 8″—at $1.25 per sq. yd	.2082	.2082	.2082	.2320	.2320	.2320	.2540	.2780	.3000	.3480	.3930	.4170	.4750	.5320	.6040
59 Concrete 8″—at $4.00 per sq. yd	.6660	.6660	.6660	.7420	.7420	.7420	.8130	.8900	.9600	.1112	.1260	.1332	.1520	.1702	.1930
60 Brick on 6″ concrete—at $5.00 per sq. yd	.8330	.8330	.8330	.9270	.9270	.9270	1.0150	1.1120	1.2000	1.3900	1.5720	1.6660	1.9000	2.1300	2.4100
61 COST of connection at intersection (see line 64)	.65	1.00	1.50	3.00	10.00	14.00	20.00	27.00	34.00	47.00	57.00	68.00	95.00	158.00	268.00
62 COST of valves with small boxes (see line 64)	6.50	9.00	12.50	12.50	18.00	27.00	39.00	61.00	78.00						
63 COST of valves vaulted with brick (see line 64)					30.00	39.00	55.00	78.00	97.00	270.00	350.00	427.00	593.00	918.00	1390.00

64 Multiply number of each by unit cost and divide by length in feet for cost per foot

65 Treat specials as in line 64

66 Add 10% for supervision and small tools—5% for work in intermediate sections & 10% for congested sections

These tabulations do not include fire hydrants, office overheads, engineering, fixed charges, insurance, first aid, etc. Units and costs are based on using workers and laborers experienced in water works construction. For inexperienced workers and common labor the units will be somewhat lower and costs per foot somewhat higher. Units and costs are also based on best conditions in outlying partially built up sections. For mains in open country make proper adjustments of items affected. Backfill based on total depth with street opened to traffic and paving done somewhat later. If paving is to be done along with job, make proper adjustments of items affected. For small jobs during which men assemble at shop and are transported on department time, make proper adjustments of labor costs. Roughly each half hour so consumed adds 6% to labor costs, although other advantages may offset this added cost depending upon number of men involved.—D. R. TAYLOR, Roanoke, Va.

AQUA AMMONIA FOR CHLORAMINATION

Proves Advantageous at Washington, D. C.

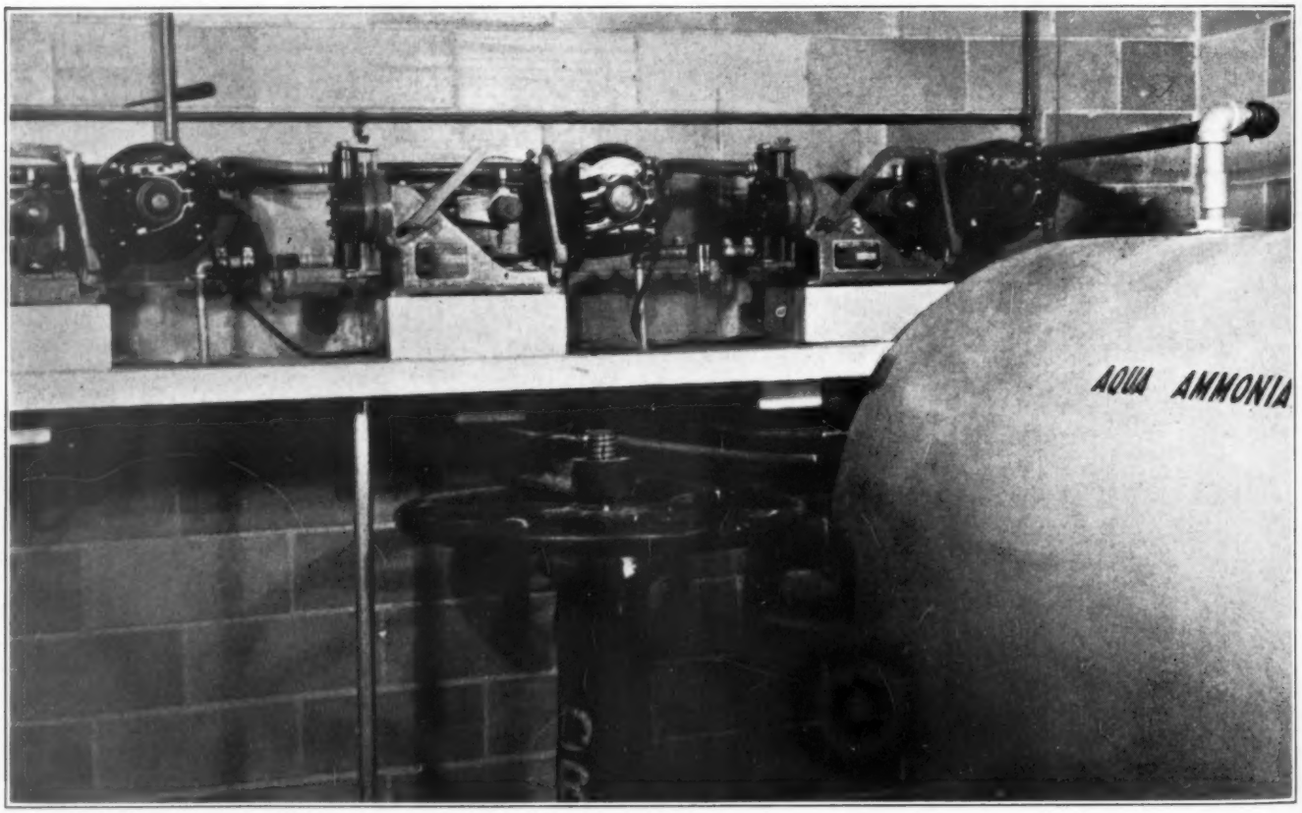
By CARL J. LAUTER
Chemical Engineer
DALECARLIA FILTER PLANT
WASHINGTON, D. C.

THE use of ammonia with chlorine as a sterilizing agent has already been exhaustively treated in literature, but it is still a somewhat controversial subject. In one of the earliest installations in this country, Race of Montreal used calcium hypochlorite and ammonia. Later, with the introduction of liquefied chlorine and gas feeders, the use of ammonia was neglected. It was not until efforts to prevent taste and odors were begun that ammonia with chlorine again came in for general attention.

Anhydrous ammonia and liquid chlorine became the most widely used products in the application. Salts of ammonia, notably the sulfate, were later employed because of the lower cost of ammonia in this form. However, the use of ammonium sulfate often involved considerable handling difficulties. The material, after standing in storage cakes rather hard and unless it is fed soon after receipt, will increase labor costs and will also present feeding difficulties.

The Author

Aqua ammonia, which is a 29.4% solution of ammonia gas in water, has only recently come to the front in the chloramine process of water sterilization. Weir of Atlanta has been using it for several years and Atlantic City adopted it only last year. There seems to be no good reason why its use should not have become more general before this, since its price per pound of ammonia content seems to be the minimum for a good source of ammonia for water works use. Lack of proper feeders for good proportioning of the liquor may have retarded its adoption before this. There are now, however, several very good small feeders on the mar-



Arrangement of Solution Tank and Ammonia Feeders
Two are for Pre-Ammoniation; One for Post-Ammoniation; A Compact, Easily Controlled Layout of Great Flexibility in Feeding Capacity.

ket which are especially suitable to the character of the solution.

Washington Experiences

At Washington, D. C., chlorination of the city water supply was first initiated in 1923, liquid chlorine being added to the effluent from the McMillan slow sand plant. This has been continuously applied ever since at this plant with excellent bacterial results, but occasional winter chlorinous tastes have been experienced. In 1927, upon completion of the Dalecarlia rapid sand plant, post chlorination was immediately put into effect and, in 1928, prechlorination was added. The advantages of prechlorination were at once apparent, the chlorine being applied to the effluent from the settling basins just before going on to the filters. However, there were still some days when coliform organisms passed the filters and there were some chlorinous tastes noticeable at times during the winter months. In February, 1933, ammonia with chlorine in the pre-treatment was begun at Dalecarlia and immediately there was a betterment in filter effluent, in the condition of the filters, and in the absence of all chlorinous tastes in the water delivered to the city. The coli aerogenes index of the finished water has been practically zero since this date, with chlorine residuals of .15 to .50 ppm.

In 1932, when one-ton containers were substituted for small chlorine cylinders, the cost of chlorine was cut in half, but anhydrous ammonia has remained relatively high in cost; in fact, equal to that of the chlorine when using 5 times as much chlorine as ammonia. Cutting down on ammonia costs, or finding a better source of this material was the next problem.

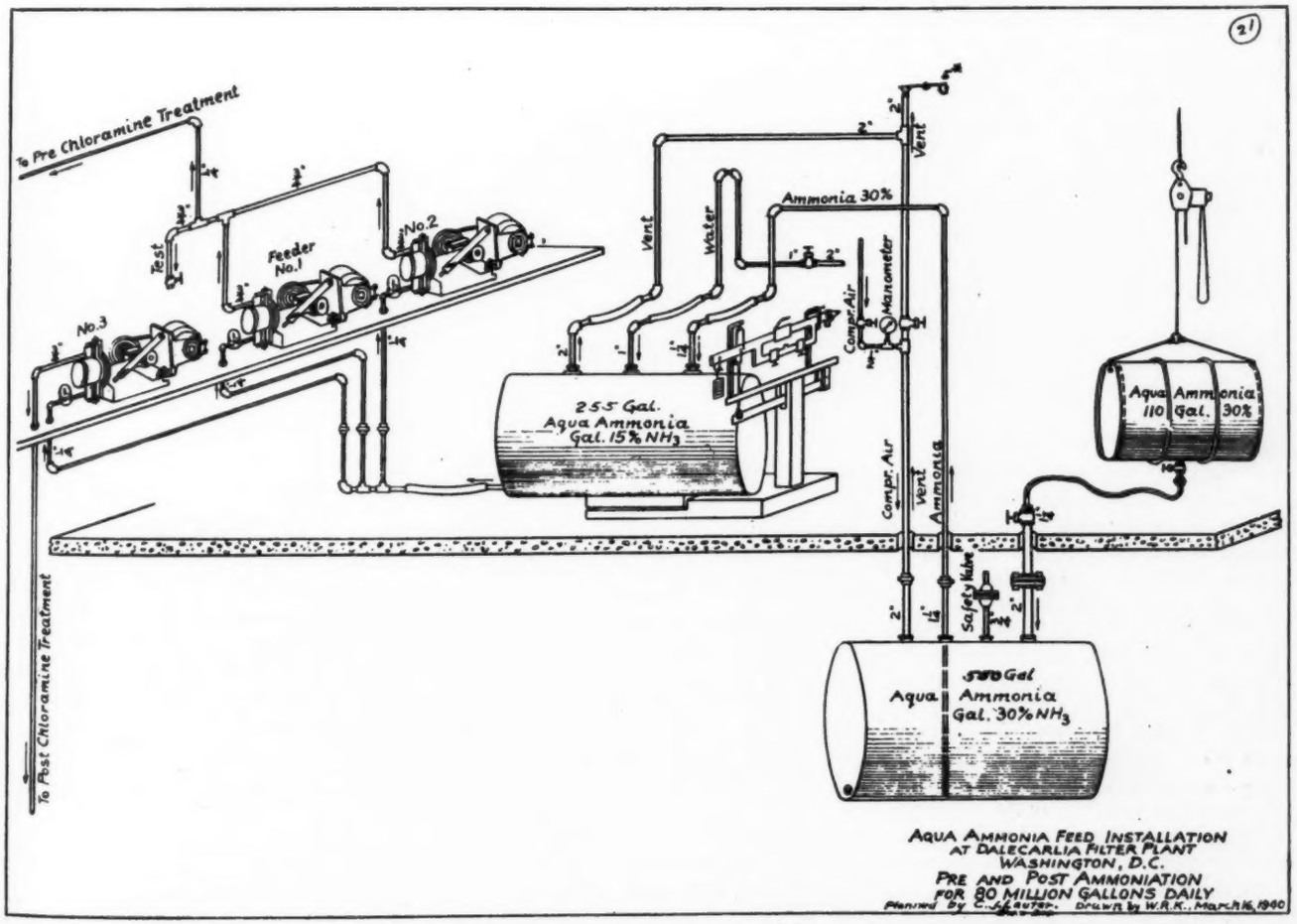
Aqua Ammonia Proves Solution

In 1938, it was finally decided to adopt aqua ammonia, due to its lower cost, and to feed it with the chlorine not only to the pre-application point but also with the post treatment, where only very small amounts of both chlorine and ammonia are needed. Since January 1, 1940, the Dalecarlia plant has been operating continuously on this basis. All aqua ammonia to date has been procured in 110-gallon drums holding 750 pounds of 29.4% NH_3 and now costing $.0225 per pound, equivalent to $.075 on the anhydrous basis. This price is for carload lots of 45 drums per minimum car at the filter plant rail siding.

Feeding equipment at Dalecarlia consists of three heavy duty diaphragm pumps (see sketch) which can be readily and accurately adjusted to the demands and to keep step with the variation of the chlorine dosages, feeding as high as 48 pounds of 15% liquid per hour from one machine, or down to infinitesimal amounts on the post treatment. The 29.4% ammonia is discharged from the 110-gallon drums from a point outdoors into a 550-gallon receiving tank located in the basement of the plant, to which it flows by gravity.

Simplicity of Operations

From the receiving drums the ammonia liquor is forced by air pressure to the operating floor above and discharged into a 255-gallon dispensing tank which is placed horizontally on a platform scale (see layout sketch). The piping is of ordinary black iron fitted with black-iron ammonia valves, copper or brass being avoided in the system. The 255-gallon tank is pumped half full of the



Sketch Showing Details of Arrangement of Feeders, Solution Tank and Aqua-Storage

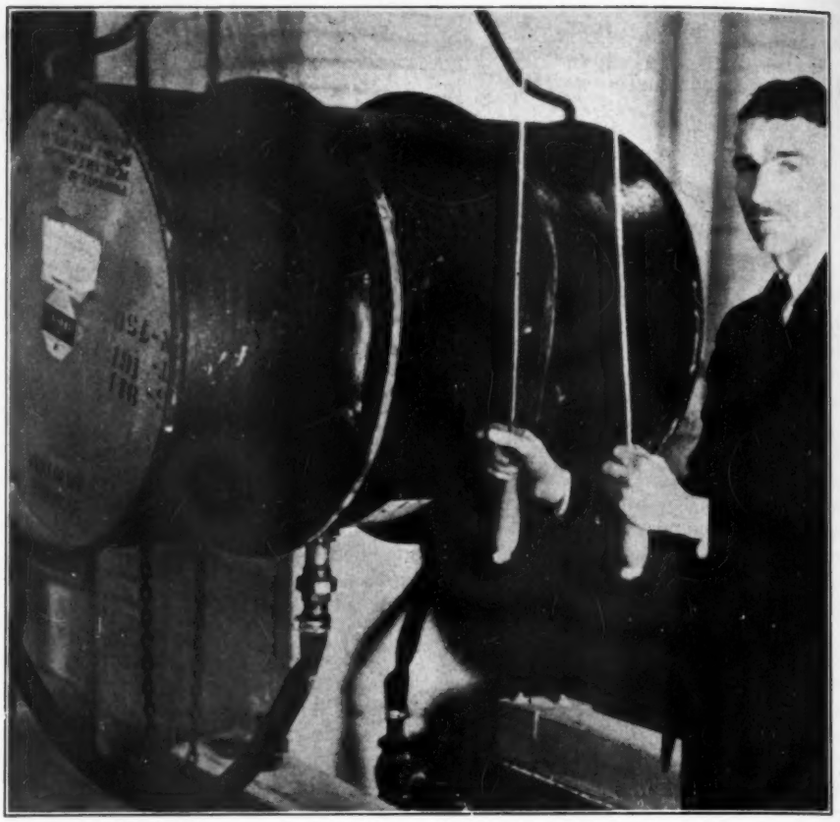
29.4% ammonia liquor, this being determined by the scale weight, after which an equal weight of water is added to bring its strength down to 15% NH_3. Since the ammonia pumped weighs 1.34 pounds less per gallon than the water, which enters through the top of the tank, the mixing is thorough. This diluting and dispensing tank has a capacity of 2100 pounds of the 15% mixture, which is immediately ready for pumping. Exact weights of both the ammonia and water can be easily transferred, as all valves are conveniently arranged in close proximity to the scale beam. The entire system is vented to the outdoors and is under a slight back pressure. This makes possible all handling and dilution without any escape of ammonia inside of the building. Dilution to 15% results in a better and less volatile solution for the feeders and also gives better amounts for hourly weight checking which, however, is not continually necessary due to the exact measuring which we have found possible with the diaphragm pump feeders. Separate pump suction lines are provided for each feeder and sight glasses give a definite indication of feeding rates at all times.

Consideration is now being given to the installation of a 12,000-gallon storage tank at a rail siding so that this aqua may be delivered in tank cars at a reduction in price over that charged for the 110-gallon drums now used.

The 15% aqua is fed to both pre and post-chlorination points. On the pre-position it is introduced into the water coming from the settling basins and going to the filters just prior to the chlorine, while on the post treatment both ammonia and chlorine are added at the same point, discharging direct into the filter effluent at atmospheric pressure.

During the last fiscal year, the annual consumption of anhydrous ammonia at Dalecarlia was 21,000 pounds, fluctuating from 25 to 100 pounds daily. All of this was added to the prechlorination point. During the summer months when demands for 4 or 5 pounds per hour existed, there was always considerable refrigeration with three 150-pound anhydrous cylinders and it was practically impossible to feed these amounts with any degree of regularity. Heating of tanks was necessary and this practice leads to fluctuations in feed rates. Uniform rates of delivery were practically impossible.

At the McMillan slow sand plant, the consumption for the same period was 3000 pounds of anhydrous. This was all added during the months of February to June, inclusive, during which time slow sand filters are at their lowest point as a biological unit and require chemical sterilization and ammoniation to prevent the ensuing chlorinous tastes often produced during these months.



Ammonia Drum In Position For Emptying Into Storage Tank Below
Contents 110 Gallons of 30% Aqua Ammonia.

Advantages Accruing

The estimated consumption of ammonia for the coming year is around 30,000 pounds as NH_3 or about 90,000 pounds of 29.4% aqua ammonia. With this amount the savings in ammonia used will be considerable, assuming that the anhydrous will continue at 15.5 cents a pound, and that ammonia in the form of aqua-ammonia in carload lots as grade B liquor can be obtained at 5 cents a pound. These figures are for material costs alone and include no charge for dispensing equipment or its operation. However, the net savings should be well over 50% of present costs of NH_3, and will give additional advantages as follows:

a) There will be no refrigeration troubles, and no heating of cylinders and hazards involved in the handling of anhydrous products.

(b) Feeding requirements can be more easily regulated, allowing minute or large dosages to be maintained as desired without fluctuation.

(c) With aqua, it is easier to arrange feeding schedules and operators are not required to handle heavy tanks at inopportune times.

Among some precautions to be observed is the fact that, as with anhydrous, the material should not be stored in hot places. It is desirable that in emptying a drum containing 30% aqua, it be cooled to at least 80 degrees if it is to be emptied at atmospheric pressure. At that temperature the total pressure of the ammonia is still below atmospheric pressure and will cause little annoyances. However, it would involve little difficulty to precool the drums and certainly would involve no more expense than heating anhydrous cylinders or placing them in a hot water bath to prevent the objectionable refrigeration when as little as 4 pounds per hour are required. The purity of the aqua product is the same as the anhydrous, because both are derived from the same source. Aqua ammonia should afford a most practicable and economical source of NH_3 for any plant operator who is interested in chemical savings and efficient applications of this solution.

IMPROVING THE OPERATION OF A SMALL SEWAGE TREATMENT PLANT*

Wherein Inexpensive Contrivances Have Played an Important Part

The Author

By C. G. WEBER
Superintendent
SEWAGE TREATMENT WORKS
ANNAPOLIS, MARYLAND

THE Sewage Treatment Works, of Annapolis, having a capacity of 3 M.G.D., was placed in operation on September 4, 1936. The treatment consists of coarse screening, pre-chlorination and primary sedimentation with separate sludge digestion in heated fixed cover digesters. The sludge is dewatered on vacuum filters.

The sewage flows by gravity to a pumping station where it receives pre-chlorination. It is then pumped through a force main to the treatment works about one mile from the pumping station.

The treatment works consists of two 150,000 gallon clarifiers, provided with sludge removal and grease skimming mechanisms; two 180,000 gallon fixed cover sludge digesters, provided with gas collection and heating coil systems; a vacuum sludge filtering system; and a fully equipped control laboratory.

Chlorination Improvements

Chlorine was originally applied to the raw sewage at a manhole on the interceptor 25-feet ahead of the pumping station and into two 10,000 gallon wet wells (Fig. 1). With this arrangement there was considerable loss of chlorine which was not absorbed by the sewage. Chlorine permeated the shredder room and other parts of the pumping station causing considerable damage to metal parts. Applications of chlorine at the rate of 20 p.p.m. seldom produced chlorine residuals in the clarifier effluents and residuals in the influent reaching the plant were not at all uniform. Furthermore, there was rapid accumulation of sewage solids in the center of each wet well which increased the chlorine demand as it accumulated. Several feet of solids would accumulate in two or three days.

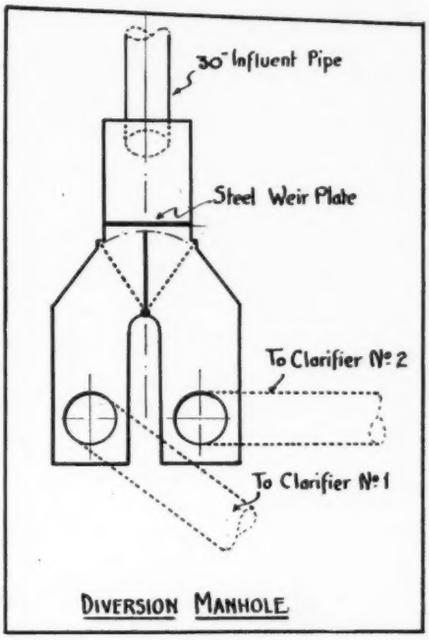


Fig. 2: Diversion Manhole
Converted Into Improvised Grit Chamber

To overcome these difficulties the chlorine solution was piped to the wet wells and applied behind a deflector placed in the wells as shown in Fig. 1. By thus changing the direction of flow of the sewage through the wells the solids were prevented from accumulating. Chlorine, applied as shown at the baffle, was thoroughly mixed with the sewage and uniform residuals appeared at the treatment plant, with chlorine dosages of 15 p.p.m. Whereas, formerly there was little or no correlation between chlorine applied and chlorine residuals, complete correlation now exists and chlorine gas is no longer noticeable in the pumping station.

There are two W & T vacuum type automatic chlorinators, the water supply for which is obtained from the Severn River. When the temperature of the water drops to 47° F. the formation of chlorine hydrate has created considerable operating difficulty.

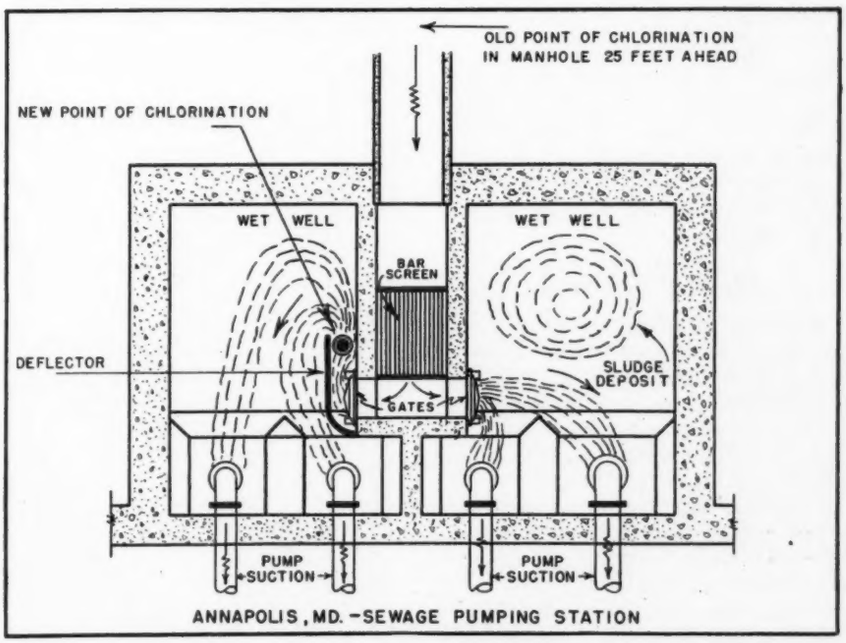


Fig. 1: Twin Pump Suction Wells
Before and After Installing Baffle, Which Prevents Sludge Accumulations and Chlorine Loss

* A paper presented before the 15th Annual Meeting of the Maryland-Delaware Water and Sewage Works Association.

A 1,000 watt heater placed inside the chlorinator was helpful but not enitrely satisfactory and very expensive to operate.

A hot water coil installed in the recirculating line of our hot water boiler, worked perfectly. During the past winter water pumped from directly under the ice was used without any difficulty.

Improvised Grit Chamber

The sewage treatment plant is not provided with a grit chamber. As a result the digester and clarifier pipes became choked with grit, making it very difficult to withdraw sludge from either unit. At one cleaning about 6 tons of grit was removed from the clarifiers. Grit also accumulated rapidly in the digester. The Annapolis system is one of those assumedly separate domestic systems.

At the influent of the plant there is a diversion chamber provided with a swing gate. Immediately in front of this gate I installed a steel dam, which made a very satisfactory grit trap (Fig. 2). The accumulated grit is removed daily, and for the past two years we have had no grit trouble.

Sludge Pumping

The withdrawal of raw sludge from the clarifiers was through two telescopic valves, into a sludge well. From the well the sludge was pumped to the digesters. Since the well was open to the air there were numerous complaints of odors therefrom during its use. Furthermore this method of removal required about six hours.

To eliminate these difficulties we removed the valves and piping and connected directly to the sludge pump suction lines, and we measure the pumpage in minutes. A gage, installed in the laboratory, indicates when the sludge is thick or too thin for further pumping.

Sludge Disposal

For disposal of the digested sludge the plant was equipped with a sludge storage tank 11′ 6″ long by 9′ 6″ wide and 10′ deep, inside dimensions. The available storage space was about 900 cubic feet. The sludge from this tank was pumped to a conditioning or ferric mixing tank, equipped with air diffusers for mixing the sludge with lime and ferric chloride. Lime was added from a lime feeder and ferric chloride was fed from an Omega Solution Feeder. The conditioned sludge then flowed to an Oliver Vacuum Filter having 65 sq. ft. filter area.

Chemical Requirements

For the first year of operations (1937), we used on a dry sludge solids basis 7.7% ferric chloride and 21% lime. As our anhydrous ferric chloride then cost $3.62 per hundred and lime cost 55 cents per hundred, our cost of chemicals per ton of sludge solids was $7.88.

We soon found that lime caused rapid cloth blinding. After dewatering about 12 tons of dry sludge solids the filter cloth had to be acid washed. This represented about 51 hours of actual filter service per cloth dressing.

In 1938 we substituted a mechanical stirrer in our conditioning tank in place of the air mixing method, and found that without any lime at all we could get good filtration when using 7.3% ferric chloride. This method increased our filter cloth life by 200%. That is we dewatered 36 tons of sludge solids, or got about 153 hours of actual service out of each filter dressing. This development reduced the cost of our chemicals per ton of digested solids to about $5.29 per ton of digested solids, a saving of $2.59 (33%). Added to this was the saving in filter cloth costs.

In 1939 we managed to get the ferric chloride consumption down to 4.6%. However, about half of the sludge filtered was partially elutriated, as, with permission of Mr. A. L. Genter of Baltimore (owner of elutriation patents), we started experimenting with sludge elutriation in our sludge storage tank during 1939.

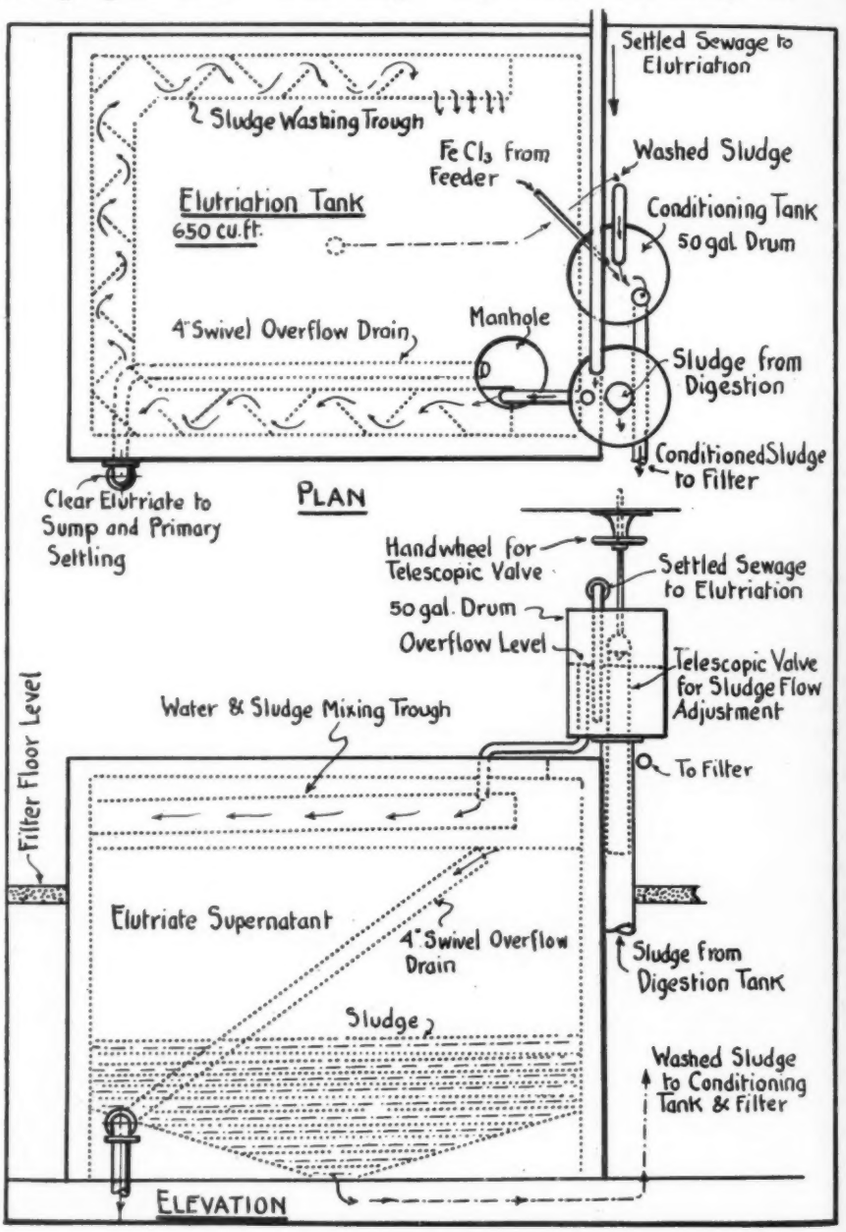


Fig. 3: Sludge Elutriation Arrangement
Sludge Storage Tank Converted Into Elutriator, Employing Settled Sewage as the Elutriating Water. Note Adjustable Mixing Tank at Top

Elutriation Experiences

Our first trials with partial elutriation showed such definite savings in chemicals, labor power and filter cloth that we arranged to change over to a better method of elutriating, and of dosing the elutriated sludge with coagulant; also a simpler and more direct method of feeding the dosed sludge to the Oliver Filter.

First of all this necessitated placing a sloping concrete bottom in the existing sludge storage tank for elutriation purposes. Without this bottom experiments had proved that we couldn't obtain at all times a sludge of uniform solid content from the flat bottomed tank for a complete filter run. I also found that the elutriated sludge coagulated so easily with ferric chloride or alum solutions that we could do away with the mechanical stirring.

Changing the bottom of the sludge storage tank and equipping it with a sludge and water mixing trough and swivel pipe for syphoning off the clear wash water or elutriate, after allowing the washed solids to settle out, reduced the available elutriation settling space to about 650 cubic feet. However, this did not handicap our operations, but greatly improved our economies.

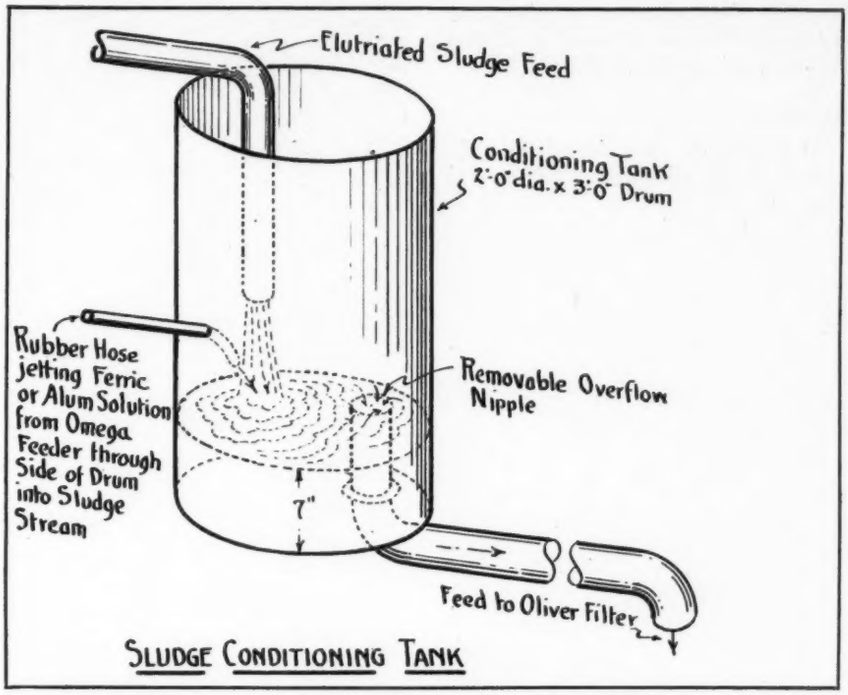


Fig. 5: Simple Sludge Conditioning Tank
From a 50-Gal. Oil Drum This Effective Mixing Unit Was Constructed. Seems to Be All That's Required for Elutriated Sludge

Settled Sewage Proves Best

For the last six months I have been experimenting with elutriation and making various changes to get the best economies from this treatment with our very limited means. We tried elutriating with well water, brackish bay water and settled sewage from the Dorr Clarifier. The latter proved the most effective and least costly source of elutriate water for our sludge. The brackish bay water, nearest our plant, actually produced a wetter cake and required slightly more ferric chloride. This was somewhat contrary to expectations.

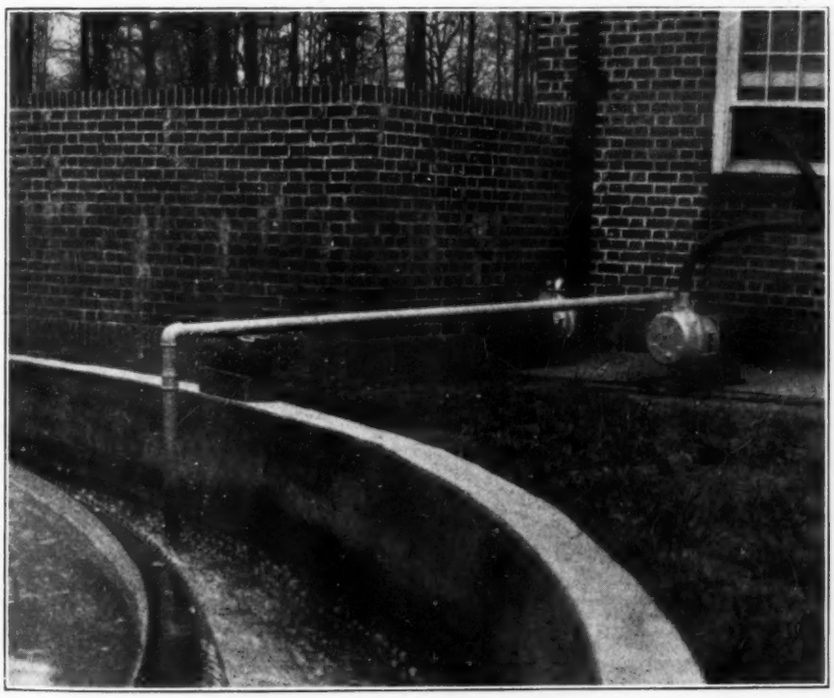


Fig. 4: Portable Homelite Pump
Delivers Settled Sewage to the Mixing "Washer Tank" (Fig. 3) at a Cost of 13c per Day

Arrangements

Our present set-up for elutriating and conditioning the digested sludge is shown in Fig. 3.

One of the telescopic sludge valves removed from the raw sludge well was placed in a 50 gallon steel drum on top of the sludge elutriation tank. When this valve is properly set by the hand-wheel there is just enough gravity head from the digestion tank to feed a steady stream of digested sludge into the drum. Settled sewage is pumped into the same drum, mixing with the digested sludge. The mixture then overflows a vertical pipe standing in the open drum and flows to the elutriation settling tank through a manhole on top of this tank. As the drawings show, the sludge and water are thoroughly mixed in a trough located in the top of the settling tank. The trough is equipped with baffles staggered at an angle. The mixture then flows into the tank, until it is practically full. After the solids have settled out, the clear supernatant is syphoned off by means of a 4 inch swivel overflow drain. This supernatant flows to the plant sump and is pumped back to the primary clarifier. The settled washed sludge is pumped to the conditioning tank, which will be described later.

In Fig. 4 is pictured the simple arrangement adopted for pumping elutriating water from the overflow trough of the primary Dorr clarifier

through the window of the filter building to "washer tank" on top of the elutriation tank.

Results

At present we are dewatering elutriated sludge with about 1.7% ferric chloride and no lime. The price of ferric chloride has advanced from $3.62 per hundred in 1937 to $4.98 per hundred at present, or almost 38% increase. Despite this fact our present cost for ferric chloride per ton of sludge solids is but $1.69, which is $6.19 (78.5%) less per ton of sludge solids than in 1937 and $3.60 (68%) less per ton than in 1938.

To be entirely fair to our present elutriation results, if we were now paying the price of $3.62 per hundred for ferric chloride like in 1938, our present cost per ton of sludge solids dewatered for ferric chloride would be $1.23 and the savings per ton of sludge solids dewatered would be $6.65, or 84.5% less than in 1937; and $4.06, or almost 77% less than in 1938.

However, with elutriated sludge at Annapolis there are other means of cutting chemical cost. We have made very successful filter runs on elutriated sludge when using commercial alum from our water treatment plant. Compared to anhydrous ferric-chloride, about three times as much commercial alum is required and the price of alum vs. ferric-chloride will determine the material to be used in the future. We tried alum on unelutriated sludge and found it unsatisfactory, as the conditioned sludge was difficult to filter and required much larger doses.

Other Savings

The savings in chemical costs are only a part of the story of elutriation economy. Our filter yields at this low chemical addition are from 8 to 10 pounds per square foot per hour and our filtering time, labor and electric current consumption has been cut in half. During 1939 when about half of our sludge was elutriated our filter blanket lasted for 123 tons of cake or over 520 hours of active service. We now hope to get 300 tons or about 1,200 hours of service out of a blanket costing about $27.

Sludge Mixing Arrangement

The details of our present sludge conditioning tank are shown in Fig. 5. This tank was made out of a 50 gallon oil drum and has no mechanical stirrer or air diffuser, so power for this purpose has been eliminated. By properly jetting the small stream of ferric chloride from the Omega

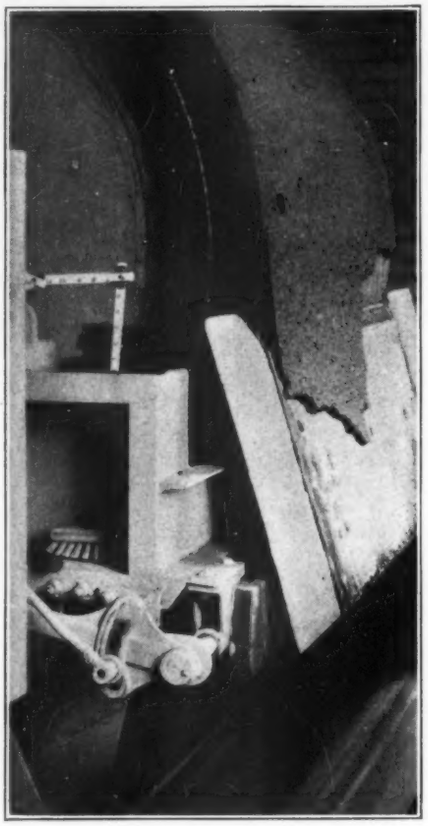


Fig. 6: Filter Cake
This ¾" Cake (8 to 10 lbs. dry solids/sq. ft./hr.) is Characteristic of Present Operations

Feeder into the inflowing stream of washed sludge, the sludge and ferric chloride or alum solution are thoroughly mixed. This is done by the agitation resulting from the inflowing sludge stream falling into the pool of sludge in the bottom of the small tank or drum. This pool is about seven inches deep and the inflowing stream displaces an equivalent amount out of the drum through a vertical pipe nipple overflow. This nipple can be lifted out of the drum at the end of filter runs so all of the conditioned sludge will be drained from the system to the filter.

With elutriated sludge this intimate flash mixing produces an excellent floc almost instantly. The conditioned sludge displaced from the drum flows downward through a feed pipe, through the end of the Oliver Filter tank to the center point without any delay. In other words the feed pipe is not the usual inverted syphon. We found that the inverted syphon was very unsatisfactory. Furthermore, feeding the sludge directly into one end of the filter resulted in good cake on half of the filter nearest the sludge inlet and poor cake on the other end of the drum. So we extended the pipe to the center.

In operating elutriation and filtration our set-up does not permit withdrawing clear elutriate while we are washing sludge because our settling tank is too small. However, as we filter sludge but two or three times every week, we draw the sludge from digester and wash it during the day preceding filtration. We then let the sludge settle over night, which produces a very clear elutriate and thick sludge. We syphon the elutriate off on the following morning and pump the settled washed sludge to sludge conditioning and the filter. We generally

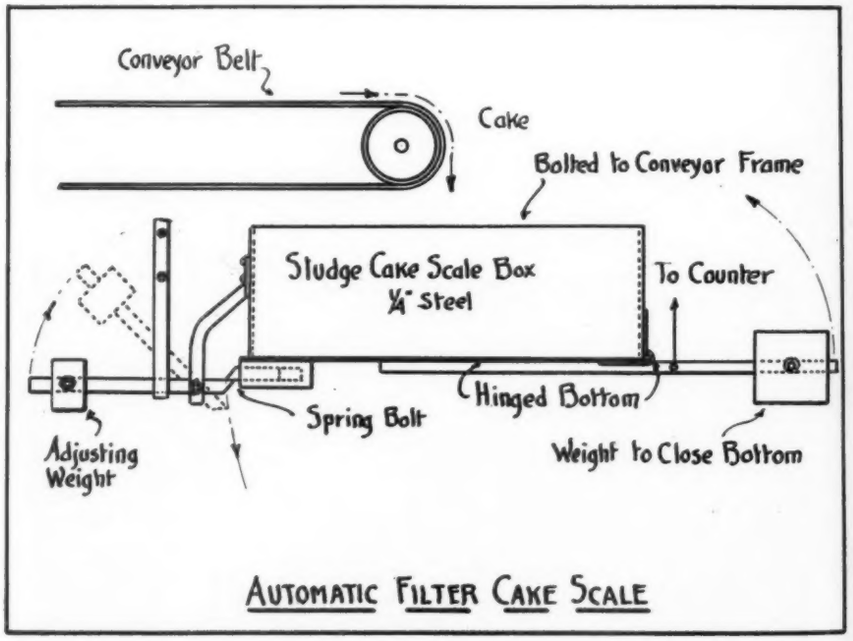


Fig. 7: "Annapolis" Automatic Sludge-Weigh-Recorder
Just a Home Made "Gadget," but it Does a Good Job of Giving Us a Record of Sludge Weight and Dumps Automatically—See Fig. 8

use about four volumes of elutriating water (settled sewage) to one volume of sludge. We filter about 2,200 pounds of sludge solids during one filter run and take about 3 hours to complete the run. Ordinarily we filter about 156 days every year, or three times a week.

Fig. 6 shows the filter cake now obtained from the elutriated sludge. Four cake thicknesses measure three inches, meaning the cake is about ¾" thick.

"Annapolis" Sludge Weigh-Recorder

Previous to the use of elutriation we had estimated the sludge solids dewatered by sampling the sludge collected in the storage tank and then measuring the cubic feet and pounds of sludge withdrawn from the tank by any filter run. When elutriation was adopted this method was not practical. I then devised an automatic self-dumping and recording sludge scale, shown in Figs. 7 and 8. The first is a sketch of this device. As can be seen this is controlled by adjustable weights, and the whole is attached to the supporting frame of the filter cake belt conveyor. At present this dumping scale is set, by the "adjusting weight" on the arm locking into the spring bolt, to release the hinged bottom door when exactly 33.3 pounds of sludge cake has accumulated in the scale box from the belt conveyor. The scale is frequently checked by diverting a dumped load to a pan on an ordinary beam scale. An ordinary revolution counter, fastened to the conveyor frame, is attached by a rod and spring to the weighted arm which closes the box bottom after each load is dumped into the truck below the box. The cake is sampled for moisture and solids determinations and by multiplying the number of cake dumps recorded on the counter by the weight of each dump and the percent solids present, the dry pounds of cake solids per run are easily obtained. The photograph (Fig. 8) shows this inexpensive and accurate device with the hinged door open above the plant truck.

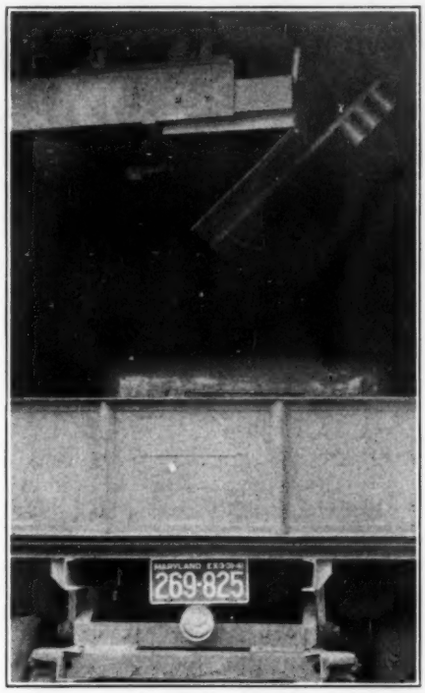


Fig. 8: The Self Dumping Weigh-Recorder

Has Just Released Its Load of 33.3 lbs. of Filter Cake Into Truck—See Fig. 7

Much for Little

All of the ideas, changes and labor relating to the foregoing changes in our treatment system were supplied by myself and others of the operating force. The cost of the materials and structural changes involved in elutriation, new sludge conditioning method and filter feeding and cake weighing amounted to less than fifty dollars.

The cost of pumping clarifier overflow (settled sewage), for elutriation with the little Homelite Portable Pump is very little, namely 13 cents per day of operation. This cost is more than offset by our saving in power for filtration.

Settled Sewage for Elutriation

(Not New at Annapolis)

This is to correct a faulty impression gained from Mr. A. L. Genter's complimentary remarks on Superintendent Weber's work at the Annapolis, Md., Sewage Treatment Plant, (page 281 our June issue).

It was our impression that Mr. Genter credited Mr. Weber with having been the first to substitute settled sewage for water in sludge elutriation practice. But, we have an explanation from Mr. Genter that he intended full credit to Mr. Weber for his initiative in proving that settled sewage could be substituted at Annapolis, with equal or better results, and a cost lower than that from other available water. He states, however, that use of settled sewage in elutriation was earlier instituted at the plants of Winnipeg, Canada, and at the Richmond-Sunset plant of San Francisco.

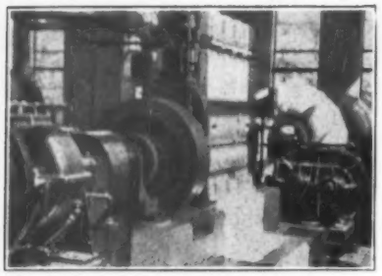
RALEIGH'S NEW FILTER PLANT IN SERVICE*

On June 18th the just completed 8 M.G.D. Filter Plant and Pumping Station of Raleigh, N. C., was dedicated and placed in service.

The accompanying picture was made while Roy L. Williams, Raleigh's Commissioner of Public Works, was speaking. On the speaker's platform (stair landing in the plant) are left to right—City Clerk, J. E. Sawyer; the Mayor of Raleigh, Graham H. Andrews; Wm. C. Olsen, Raleigh's Consulting Engineer and plant designer; W. W. Chaffin, State P.W.A. Engineer; the Reverend John T. Glenn.

Following the serious parts of the dedicatory exercises, a real Southern Barbecue Dinner of chicken and pig was served those responding to the many invitations extended leading water works men of North Carolina.

* Our October issue will feature Raleigh's new plant in an article by Consulting Engineer, Wm. C. Olsen, its designer.



Engine and Blower Room
Syracuse's Ley Creek Plant

N.Y. SEWAGE WORKS ASS'N. AT SYRACUSE

Applauds New $3,000,000 System and Plant

THE New York State Sewage Works Association held its Annual Spring Meeting in Syracuse, N. Y., where a new sewerage project, costing better than three and one-half million dollars, inclusive of an activated sludge treatment plant with many unique features, has recently been placed in operation. One afternoon was devoted to an inspection of this new Ley Creek Plant that now takes over the work of two smaller plants.

As is customary at New York's Spring Meetings, a manufacturers' exhibit was a feature, there being 22 exhibitors represented. A feature on the program was an hour of "Peddler's Patter," in which a representative of each exhibitor was alloted a three minute period in which to bring to the attention of members and guests what the exhibitor had to offer, or to see, at their respective booths.

Syracuse's New Plant

Prior to the trip of inspection, Glenn D. Holmes, Designing Engineer, in a brief description, highlighted a number of the unusual design features of the project, the key-note of which is flexibility of operation of this 4½ M.G.D. plant.

[Since the more novel elements of design in the new Ley Creek Plant are to be covered in an article by Messrs. Holmes and O'Brien scheduled for a future issue of this magazine, only a few will be mentioned in this report.—ED.]

Amongst the units is found a circular down-flow magnetite filter on the final effluent, which may be employed to further clarify settled sewage or chemically or bio-flocculated sewage, or to polish activated sludge effluent, thus producing whatever degree of treatment may be desired (Cee cut). At the time of the visit the plant was producing an effluent comprising a mixture of 50% activated and 50% settled sewage, chlorinated and passed through the filter. The circular central area, of which the filter is the circumference, is a shallow funnel shaped aerating saucer, the aeration being provided by spilling down a series of steps.

The final tanks are provided with V notch weir troughs in H design, and run back 2/3rds way to the influent end of these tanks. The piping system is largely confined to tunnels, each line being plainly numbered for identification. In one of these tunnels we counted the impressive number of 22 pipe lines and conduits, for various services, neatly supported against side walls and ceiling.

Cup Winner
R. A. Murphy, Operator
Ovid, N. Y.
(Submitted best operating records in state.)

New Board Member
Wm. Raisch, Cons. Engr., New York City
(A long record of useful service wins recognition.)

Considerable care has been given to the control of distribution of volume and solids load to the primary clarifiers, aeration units and final clarifiers. Unique in sewage treatment is the use of rotary type meters. In the two-pass aeration units diffuser plates are installed for securing tapered aeration.

From the battery of four sludge digesters, subject to highly flexible stage operation, supernatant liquor flows through the gas holder well, to serve as a seal and at the same time receiving further clarification before discharge to the crude sewage.

The chlorinator installation is designed to provide pre- or post chlorination, and also the use of chlorine at other points in the process when and if desired.

Operator's Cup to Murphy

For having turned in the best 1939 records of plant operation, the Committee on Operators' Records awarded the cup to Reginald A. Murphy, Chief Operator of the Willard State Hospital plant at Ovid, N. Y. In the annual contest a greater number of operators submitted records than ever before, so Mr. Murphy has something to be more than ever proud of.

Committee on Public Relations Established

Within the year the Association has set up a Committee on Public Relations, headed by C. R. Velzy, Works Supt. at Buffalo, who made the first progress report. The objectives of this new Committee are named as (1) Improved relations between sewage works operators and the public; (2) Education of the public in matters pertaining to sewage treatment; (3) Advancement of publicity regarding the activities and accomplishments of treatment works and personnel; (4) Dissemination of public relations type of information, through the medium of papers read before the Association; (5) Direct service to members as a clearing-house. To attain such objectives Chairman Velzy asked for the full cooperation of all members in this important activity.

Syracuse Hosts
Glenn D. Holmes, Consultant
(Long Syracuse's Engineer; Chairman of Local Arrangements)
William Gyatt, Eng'r.-Sub't., Bureau of Sewage Disposal
(Syracuse maintains its record for pioneering.)
Charles G. Hart, Supt. New Ley Creek Treatment Wks.
(From chlorinator sales; to Water Supt., and now into the "Used Water" business; is Charlie's history)

Technical Sessions

The first scheduled paper was that by an active member of the Long Island Section — *Clarence MacCallum,* Consulting Engineer of Mineola, L. I.—who presented something of a review of progress in *"Training Operators of Sewage Treatment Plants"* in New York State. In this he outlined the successes and shortcomings of the courses of two weeks duration given by N. Y. University, Cornell and Rensselaer Polytechnic Institute, such being required of operators applying for an operator's license in Grade 1 or 2 under the new State Sanitary Code regulations. Mr. MacCallum then revealed what the Long Island Section of the Association had been doing in the way of holding "prep schools" for its member operators, consisting of two evening classes each week for 4 weeks. Such schools had proved very popular, 27 operators having attended 6 or more of these sessions, which always ended in a question period. He commended the plan to other sectional groups.

In discussion *A. F. Dappert,* N. Y. Dept. of Health, pointed out that the men who hadn't made the grade in the 2 weeks short courses at the three universities were those of very limited experience. In New York there are now the following approved operators:

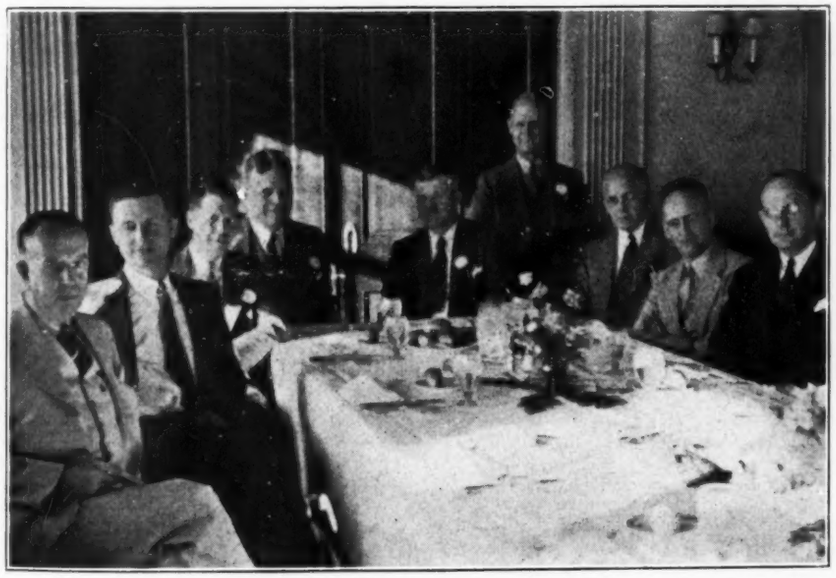
Grade 1	42
Grade 2	58
Grade 3	250

Only were grade 1 and 2 operators required to pass the 2 weeks training courses. Actually Grade 2 operators were now operating Grade 1 plants in several instances, pending attainment of Grade 1 ratings. During such periods waivers are allowed those with background and promise.

[To us it seems very significant, and encouraging, that the requirement that a municipality must employ a certified operator has opened up the question in New York State as to whether or not sewage operators do not rightly belong under Civil Service in the final analysis. The whole movement may in the end result in Civil Service ratings for operators as the ultimate attainment. If so the licencing movement will have served its purpose most laudably.—ED.]

C. R. Velzy, Supt. Buffalo Treatment Works (Heads new Public Relations Committee)

Wm. C. Hamm, Supt., Port Washington, L. I. (The Dean of New York Operators)



The Executive Board in Session

From the left: "Bob" Wheeler (Albany); "Jo" Rehler (Olean); "Rod" Cook (Riverhead, L. I.); Newell Nussbaumer (Buffalo); The President, Geo. Anderson (Rockville Center, L. I.); John Skinner* (Glendale, Calif.); The Secy.-Treas. "Art." Bedell (Albany); Vice-Pres. "Herb" Wagenhols (Syracuse); "Bill" Stanley (Ithaca). [*As immediate past-president Mr. Nussbaumer is the Advisory Member. Past-president John Skinner, of California, was the honored guest. Other past-president guests, not in the picture, were Morris Cohn and Linn Enslow. A late arrival was Director Henry Ryon (Albany); and ill at home was Chaunce Samson, Western N. Y. Director, from Kenmore.]*

"The Main Sewage Treatment Plant of Syracuse" by *Wm. Gyatt,* Supt., Bureau of Sewage Disposal, Syracuse, N. Y.

In Mr. Gyatt's brief review of betterments to the original 32 m.g.d. main disposal plant of Syracuse, now raised to 56 m.g.d. capacity, he called attention to the fact that it was the first plant of any size to install mechanical Dorr Clarifiers, that being 14 years ago. He referred to the economical and nuisanceless method of disposal of Syracuse's crude sludge by pumping it to the Solvay Company's alkali-waste ponds, 5 miles distant, through a 5 inch pipe line.

Included in the recent plant betterments are increased weir lengths by suspending take off troughs in the clarifiers. A new chlorination station was being added to provide prechlorination for 107 days each year; also a new laboratory. The chlorinating equipment represented another bit of Syracuse pioneering in that the new W. & T. Residual and Chlorine Potential System was being installed to insure an effective dosage at all flows and under varying conditions of chlorine demand of the sewage. In his opinion there would result an overall economy in chlorine consumed and, with it, insured efficiency. The chlorine will be applied ahead of the grit chambers and the control samples to the regulator unit automatically drawn a few minutes beyond the point of application.

"Operating Experiences at Buffalo" —by *C. R. Velzy,* Works Supt., *J. W. Johnson,* Asst. Supt. and *George E. Symons,* Chief Chemist, Buffalo Sewer Authority.

Dr. Symons, in presenting a part of this paper told of experiences in cleaning 660,000 feet of sewers and the great loading of grit, rags and stranded debris which came down on the new plant, to all but swamp it. Even now Buffalo grit contains an inordinate organic content, which necessitated incineration of all grit removed, averaging 12,000 lbs. daily. The clarifiers remove 85% of the settleable solids (45% of total suspended solids) and the fluctuation in solids removed runs from 5,000 to 500,000 lbs. per day—grit included. Thus it could be seen that one of the greatest plant assets were the sludge storage tanks which backed up the primary digesters and smoothed out the loadings on the vacuum filters and incinerators.

In the primary digesters scum (better described by Velzy as "top sludge") extended down 6 to 8 ft. compacting to a mass containing 13 to 32% solids, beneath which at va-

rious times could be found 0 to 8 ft. of pretty foul so-called supernatant. He described a home-invented bullet headed sampler for scum and sludge sampling and useful in keeping a sludge inventory. In handling crude and digested sludge quite a problem was that of extremely fine sand and silt (40% through 200 mesh sieve) passing the grit chambers and settling out in the clarifiers.

Programmers

"Doc" Geo. Symons, Chief Chemist, Buffalo Sewer Authority

H. E. Milliken, Chemist in Charge, Auburn Treatment Plant

J. T. Lynch, Supt. of Sewerage, Auburn, N. Y.

As to difficulties in vacuum filter operations, Dr. Symons related how high lime dosage of the digested sludge had caused blinding of filter cloths and chokage of supporting wire mesh (¼") on the drums, necessitating removal by revolving the drums in a muriatic acid bath in the filter vats. More recently the lime had been reduced to 6% (dry basis), allowing a ferric-chloride cut to 1.9%, to produce a filter cake of 63% moisture. As to bookkeeping, all sludge cake, all chemicals and all incinerator ash were weight recorded automatically.

Concerning the results of chlorination (pre-chlorination) at Buffalo, Dr. Symons showed that the bacterial loading on Niagara River filter plants had been reduced to about 7% of that previously dealt with by these plants. He also revealed accomplishments in the direction of building good public relations and the fact that a belligerant newspaper had been won over in so doing. The attractiveness of the plant ground had attracted many visitors, especially so since a vantage point (300 car parking space) for watching sunsets, and permitting fishing from the dock had proved additional attractions.

Dr. Symons emphasized the value of safety drills regularly staged at the plant, and remarked that nothing short of an actual drill was the truly reliable preparation for possible emergencies.

Mr. Velzy, in presenting his part of the paper, employed lantern slides in recounting experiences. The first was a grease ring building up in sludge force mains to cause pumping pressure to mount from 20 lbs. to 50 lbs. and a sizeable drop in pump output. The grease was removed by a steaming-out procedure. As to the "top-sludge" problem, the earlier scheme of attempting its handling alone had been superseded by pumping scum and bottom sludge together. To keep the scum more fluid sprays beneath the floating covers and supernatant recirculation had been resorted to.

In vacuum filtration the chief difficulty had proved to be a proper synchronization between filter cake production and incinerator operation, necessitating the addition of a sludge cake surge bin between filters and incinerators. In chemical conditioning, improvements had been continuous. The most recent had been dilution of the 40% ferric-chloride solution, and securing an improved rapid mix. For filter cloth the fuzzy "Canton Flan-

Programmers

Wm. D. Denise, Supt., Treatment Works of Greece, N. Y.

C. J. McInerny, Chief Operator, Treatment Works of Elmira, N. Y.

Clarence McCallum, Cons. Engr., Mineola, L. I.

nel" cotton cloth has proved best—giving 250 hrs. of service. Narrowing the spiral wire winding to 1½ inches between wires on the drums had extended filter cloth life.

As to incineration, the wet cake (63 to 70% water) is mixed with 4 parts of dry sludge (2 to 8% water) passed through the cage-mill type flash-dryer and to the furnace. If bottom sludge is burned alone some auxiliary fuel (sludge gas at 1.2 cu. ft./lb. dry solids) is required to maintain furnace temperatures. If "top sludge" is burned alone water sprays in the incinerator must be turned on to suppress the burning rate. The dried sludge enters the fire box as any powdered fuel would. Due to the fine sand in the sludge, cutting through of the feed line at a goose neck has been a problem. This had been overcome by casting a concrete wearing block to fit over the cut through section, the 3 in. thick blocks being replaced when worn. Metal patching had not been successful. Other damage from abra-

The Weighty End of Long Island's Section

Mineola's Supt. of Treatment Frank Hall

Freeport's Commissioner, Frank Holland (The operator's best friend is a light weight only in frame)

"Larry" (Lawrence L.) Luther (Dynamo of the L. I. Section; is Freeport's "Super", in every sense)

sion has necessitated rotation of shut down of the three incinerators for repairs every 3rd month. Repairs to fan blades and liners with the very hard "Stellite" alloy and other materials had been unsuccessful and costly. Now the scheme is to employ inexpensive steel replacements and throw the worn parts away. The bars in the squirrel-cage flash drier require an arc-welding build up every 3 months. It is planned to try placing of easily replaced wearing sleeves over the bars.

Concerning grit burning, Mr. Velzy reported that it burns about as readily as bottom sludge from the digesters, and is fed along with the mixed bottom and top sludge in ratio of about 1 grit to 4 sludge. In fact, grit alone was once burned satisfactorily and its incineration presents no problems beyond abrasion.

Sludge Filtration and Incineration

(A Symposium)

The topic "Sludge Filtration and Incineration" was dealt with by 4 operators, following the introductory review of progress in this phase of modern sewage treatment presented by Wm. Raisch, Consulting Engineer, who thereafter presided during the symposium.

Filtration

Mr. Raisch's very illuminating review revealed the rapid growth of vacuum filtration of sludge in recent years, this method of dewatering now being practiced at 104 plants having a total filter area of 70,000 sq. ft. The largest (Chicago) has 13,680 sq. ft. of filter area and the smallest (Wau-

At the New Ley Creek Plant

Interesting was the comparison of activated effluent on left and settled sewage on right spilling over facing weirs (center picture), where the grey slime and the green algae growths seemed to belong on different sides of the "railroad tracks"

sau, Wisc.) only 50 sq. ft. As to relative sizes of such plants, 51 serve more than 25,000 population; 32 serve between 10,000 and 25,000; only 5 serve less than 5,000 population. Interestingly only 3 of the 104 plants are in the far West; only 9 west of the Mississippi. Regarding types of sludges thus dewatered, the following break-down was cited:

Type of Sludge	No. Plants	% Total Area
Primary	10	6
Activated	8	27
Primary and Activated	5	24
Chemical Ppt'd.	19	7
Digested*	62	35

(*Activated or Primary)

Of the 62 on digested sludges only 19 are in communities of less than 15,000. Of the 19 on chemically precipitated sludges only 8 serve populations of less than 15,000.

Incineration

The practice is in use at 41 plants having incinerator capacities varying between 924,000 lbs./24 hrs. (Detroit) and 3,432 lbs. (Tenafly, N. J.) of dry weights of solids—the following being the breakdown.

Type of Sludge	No. Plants
Primary	7
Activated	3
Activated + Primary	1
Chemical Ppt'd.	11
Digested*	19

(*Activated or Primary)

The 19 plants incinerating digested sludge represents almost half of the total number, with chemical sludge a close second. As to populations served, 60% of the plants served populations of more than 25,000 and only 10% less than 10,000 pop. Grit is being burned in at least two plants —Milwaukee and Buffalo.

Mr. Raisch pointed out that a study of the situation indicated vacuum filtration to be economically feasible as a general rule for cities of 15,000 population and up. As to incineration, the economy comes in plants serving 25,000 persons and upwards, the ideal advantage being found in plants serving 100,000 pop. and better.

Mr. Raisch's paper provides essentially a complete listing of the 104 vacuum filter installations, revealing basic data such as type of filters, number of units, and population served.

Earl F. O'Brien, Associate,
Glenn D. Holmes, Engr.,
Syracuse
(Program Committee Chmn.)

Al. G. Martin, Comm. of Sewerage,
Town of Tonawanda,
Kenmore, N. Y.

Wm. S. Hults, Comm. of Sewerage,
Port Washington, L. I.
(As a boy, played around "Dean" Hamm's Imhoff tanks; 'till then never knew anything foamed but ice-cream sodas)

A companion list records like data for the 41 incinerator installations.

The second paper was that of Mr. Velzy revealing Buffalo experiences. His remarks have already been incorporated under "Operating Experiences at Buffalo."

"Experiences at Auburn, N. Y." were presented in a paper by *J. T. Lynch,* Supt. and *H. E. Milliken,* Chemist of this plant, which provides chemical precipitation seasonally. The sludge is conditioned with ferric-chloride and hydrated lime, the dosage being changed by varying the rate of sludge feed and holding the chemical application at a constant rate. At Auburn they had found the iron dosage productive of a pale pink effluent to give the best overall results. The incinerator of the mutli-hearth type had earlier given smoking troubles due to overloading. The air pre-heater had been removed because of soot clogging; and thereafter incinerator capacity had increased by almost 9%. By removing the shaft cooling fan another gain of 9% had been realized, and a saving in fuel also resulted.

"Experiences at Elmira, N. Y." were presented by *G. J. McInerny,* Chief Operator, Elmira Sewage Treatment Works, who reported that anhydrous ferric chloride had been discontinued since being able to obtain the liquid form in 12 gal. carboys at the same price per pound for the ferric-chloride content. The sludge handled is primary or chemically precipitated solids, producing cake yields averaging 6 lbs.-sq. ft./hr. burned in a Nichols Multi-Hearth Furnace. Ferric chloride saving had resulted since application of the conditioner to the sludge entering the filter vat. When poor filter yield resulted from grease, a boost in the lime dosage had proved helpful. He stressed the importance of dependable pumps, for delivering of sludge to the conditioning tank, as the key unit to successful filtration and incineration. To keep a check on the rapidity of scaling up of filtrate pumps a sight glass (gauge glass) had proved very helpful as an indicator of need of cleaning the pump. He also

(1) *H. D. Hutcheson, Chief Operator, Newark, N. Y., and S. E. Pinkney, Chief Operator, Webster, N. Y.*—(2) *Com. Porter, Supt. of Sewerage, Ballston Spa, N. Y., and Benjamin Miller, Chief Operator of Courtland, N. Y. (has a nice new plant).*—(3) *More Long Islanders—John Stepois, Operator, Central State Hospital (Islip); Jas. McShea, Operator, State Hospital, (Wassaic); Herbert O. Johnson, Supt. Belgrave Sewer District, Great Neck, L. I.*—(4) *Geo. A. Mowbray, Supt. of Sewerage, Port Chester, N. Y., and Henry M. Rath, Supt., Tallman's Island Plant, N. Y. City.*—(5) *"E. B. G.'s" "Jo." Wetherell (N. Y. C.) gets a break, having his picture taken with no less than the President of the Association*

cited the value of a dependable temperature indicating (preferably recording) unit for observation and a guide in regulating filter cake input to the furnace. There had been some difficulty with oil burners carbonizing and also chokage of the pre-heater with carbon deposition. In operation of the three units (sludge pump, vacuum filter and incinerator), Mr. McInerny stressed the need for synchronization, and painted a picture of what can happen when one unit of this 3 ring circus begins to fail for one or another reason. Above all a dependable supply of sludge, and that meant assured sludge pump dependability.

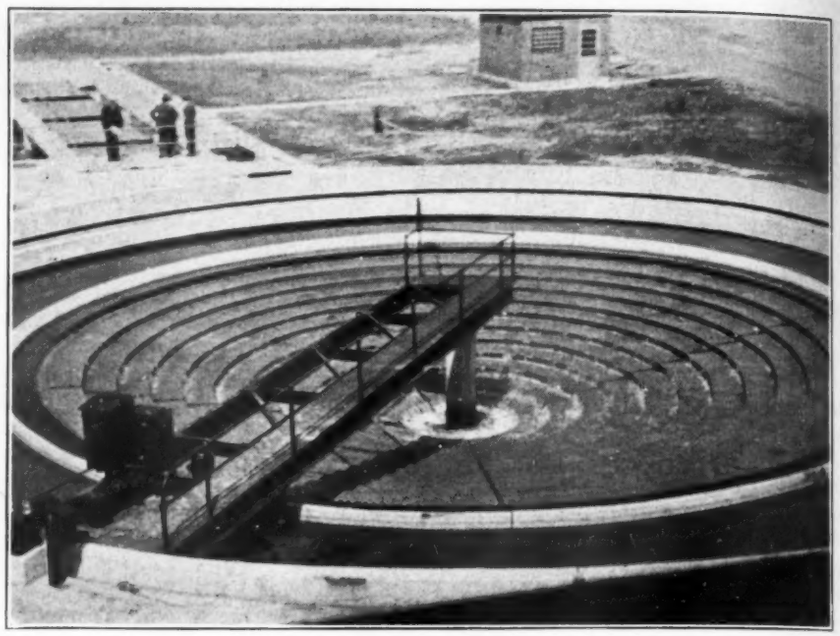
"Experiences at Greece, N. Y." were presented by *Wm. D. Denise,* Supt. of Treatment at Greece, where magnetite filters polish off the effluent leaving the final tanks, and sludge dewatering and incineration is practiced only at 10 day intervals. At Greece ferric-chloride solution is also bought in 10 gal. carboys—the 40% solution being diluted to 15% for use in conditioning. Results therefrom had been a reduced consumption of ferric chloride, said Mr. Denise. The baffled mixing tank equipped with air agitation had been equipped with rotating (6 r.p.m.) paddles, with decided benefit. On the Oliver filters, wool cloths had given 300 hrs. of service as compared to 130 hrs. for cotton with flannel finish. However, cotton had proved overall more economical, the cloths being cleansed by water spraying every 6 hours. The best drum submergence appeared to be 8 inches, producing ½ to ⅝" thick cake carrying 75% moisture.

Concerning incineration of sludge cake in a 6-hearth Nichols-Herreshoff furnace, the average hours of operation had been but 68 hrs. per month, operating only at 10-day intervals. Trouble with plugging of rabble teeth had been corrected by removing alternate teeth on each arm. Likewise, had the nuisance of the very fine dust in the ash been overcome. [If details as to how were given we missed them. If others have the dust problem, Mr. Denise should be consulted.—Ed.]

Discussion

In the ensuing discussion, covering all papers presented in the symposium, and in reply to questions asked the following developed:

Mr. Velzy stated that the grit chamber velocity at Buffalo was about 0.75 ft./sec., the resulting grit containing 30 to 40% organic matter. Still, much fine sand went through to the clarifiers. It was chiefly this 200 mesh sand that was responsible for the abrasion troubles. To remove the troublesome sticks and rags from the grit, screening of grit had been contemplated but seemed impracticable.



Ley Creek's Giant Saucer
The Most Novel Unit at Syracuse's New Activated Plant.
(Sludge floc may pass over the weirs—but who worries? Receiving a shot of chlorine the effluent is strained through the annular magnetite filter and then sparkles down the steps of the saucer-like aerator, freed of bugs and saturated with sunshine and oxygen.)

George R. Lewers, Underpinning and Foundation Co., New York City, corrected an impression that Buffalo had been the first to incinerate grit, pointing out that the practice had been in successful use at Milwaukee for 3½ years. There a rabbling type furnace had been employed without difficulties, because there were no high velocity currents of grit or other solids.

Stanley E. Kappe, Chicago Pump Co., Philadelphia, said that the formation of a grease ring in sludge mains was not new. In fact, the friction built up had been responsible for failure in pump deliveries because of the increased friction head thus created. He said that velocities through sludge pumping lines should not be less than 2 ft./min. To overcome ring formation, higher rates of pumping was the most practical solution.

C. C. Agar, N. Y. State Dept. of Health, stressed the difficulty of maintained synchronization of rate of filter cake production and incerator operation and said that something in the nature of a sludge cake "reservoir" was sorely needed in the system to keep the incinerator going on an even keel.

L. H. Enslow, Editor, "Water Works and Sewerage", said that it had been very apparent from the New York experiences recited, and experience generally, that in conditioning digested sludges the general rule was that of addition of the coagulant followed by a thorough but brief agitation and, thereafter, delivery of the sludge through the shortest and straightest pipe practicable to the filter vat, preferably at the center point. Apparently in this manner the clots were the largest and the water maintained in its freest state. Likewise, it had been learned that considerable improvement in lengthening cloth life and increased filter yields resulted through holding the lime dosage to the lowest permissible quantity and increasing the ferric coagulant. Sight must not be lost of the overall cost when considering the chemical cost alone. However, the high lime dosage may be necessitating higher dosages of the more costly ferric coagulant.

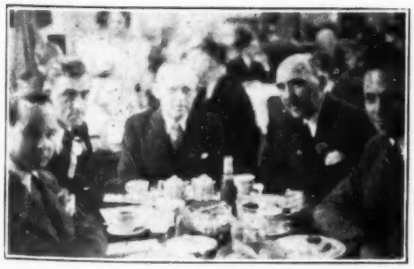
As to sludge pumping, he had been impressed with the general need for putting more guts and less so-called efficiency into sludge pumps. He agreed with Mr. Kappe that velocity would keep down the choking grease ring, and if the pumps had the proper head characteristics and extra strength built into them the question of ultimate velocity required for keeping the bore adequate would take care of itself automatically. This matter of falling pump output with increasing head constituted the endless chain of defeat. So, the moral was to build the line large enough, but specify pumps to cope with heads in

(1) *Henry Ryon, San. Engr., State Dept. of Public Works, Albany;* (2) *"Larry" Peck, Wallace & Tiernan Co., Albany;* (3) *A. H. Hale, Chief Operator, Brighton, N. Y.;* (4) *R. K. Patterson, Johns-Manville Co., N. Y. City;* (5) *John J. Costello, Supt. of Sewerage, Elmira, N. Y.;* (6) *Wm. Edwards, Chief Operator, State Hospital, Gowanda, N. Y.;* (7) *"Bill" (J. W.) Fenger, Mathieson Alkali Wks., Hamburg, N. Y.;* (8) *Wm. A. Ryan, Consulting Sanitary Chemist, Rochester, N. Y.;* (9) *Fred W. Fuchs, Turbine Sewer Machine Co., Milwaukee;* (10) *Glenn Searles, Supt. of Sewerage, Rochester, N. Y.;* (11) *B. W. Catalene, Mine Safety Appliances Co., Pittsburgh*

excess of anything anticipated. Then the ring could build up to a bore where the velocity would preclude further closing in and further head loss would cease. As compared to performance expectancy and dependability, economy in sludge pumps or in power requirement must be considered decidedly secondary. Citing an example, the Syracuse case was taken as one "right at home." Here the 5-mile long line is apparently self-scouring. The plunger sludge pumps work against a head of 300 feet, but never have given trouble from line chokage, and they have never been heard to groan that they "couldn't take it." This fact was later confirmed by Mr. Gyatt, for a number of years Supt. of Syracuse Treatment Works.

Came the Dawn

On the last morning was staged the famed "Sunrise Breakfast," initiated some years ago for the purpose of getting out the sleepy ones to hear the "Question and Answer Hour" known as the "Question Box." Also to give representatives of exhibiting firms a chance to explain their wares in an hour of "Peddler's Patter," of which Morris Cohn had charge. The "Patter" was rather thin, in as much as many of the "Peddlers" failed to respond to the roll call, and others hadn't much to say that was new. In the absence of C. C. Agar, Mr. Cohn also conducted the "Question Box" discussion. Such was more successful. Through the questions the following was developed:



"Peddler's Platter"
(More sustaining than "Peddler's Patter") Dealing from the left—Jimmie Angell, Jr., ("Water Works and Sewerage"); Jim Burnette (Vapor Recovery Systems, Inc.); "Al." G. Martin (no "peddler" is he, but the Commissioner of Sewerage, Kenmore, N. Y., who is getting set for a golf match); Ray Jerge (Pittsburgh Equitable Meter Co.); F. F. Teutschert, (The Dorr Co.)

Incinerator Operation

Concerning intermittent operation of sludge incineration, and possible ill effects on the furnace from repeated coolings and heatings, Mr. Denise stated that they had noted no bad effects to the Greece installation, the practice being to raise the temperature gradually at the rate of 20 to 30 degrees per hour in the heating up period. Then, when shutting down to leave the fans running until a temperature of 600 or lower had been reached. The fan is left running only to protect the central shaft of the rabbling type incinerator.

A. J. Fuller, Dist. Engr., N. Y. Dept. of Health, Geneva, N. Y.

E. A. Marshall, Supt. Sewerage, Geneva, N. Y. (Secy., Genesee Valley Section)

Sam. I. Zack, Engineer, Filtration Equipment Corpn., New York City

Dr. George Symons, reporting Buffalo experiences, said that the incinerators (flash drying type) are down over Saturday and Sunday each week. They are heated up in a 4-hour period of digester gas burning. After 2 years of such operation no damage had been noted.

R. K. Patterson, Johns-Manville, New York City, explained that thin-walled furnaces were less apt to give trouble due to the contraction and expansion of cooling and heating. The abrasion question seemed far more serious than heating and cooling.

Freezing of Floating Covers

In Olean, N. Y., *J. E. Rehler,* Supt. of Water and Sewerage, reported that the scum under floating covers froze 5 to 6 ft. down last Winter, causing tilting of covers and sudden loss of gas. The suggested corrections were two—(1) Use oil as the seal liquid between digester skirt and tank walls. (2) When the floating cover became frozen operate as with fixed covers and employ a small automatic boosting pump on the gas outlet lines, to prevent cover tilting.

Solids Determination in Sludge

The question was "Is there a satisfactory method of centrifuging sludge samples, and estimation of dry solids content therefrom, without evaporation, weighing, etc.?"

Dr. Symons reported that it might be done as a measure in routine control. The formula as it worked out for Buffalo was—

$$\frac{\%\ \text{Volume of Centrifugal Solids}}{4} = \%\ \text{Solids by Weight.}$$

This method is followed in keeping a sludge inventory at the Buffalo plant. For other sludges the factor of 4 may well be some other figure, however.

Extending Filter Cloth Life

It was revealed that the life of filter cloth had been extended by reducing the spacing between the spiral wound wire to 1½ inches as earlier mentioned by the Buffalo operators.

Residual Chlorine Estimations

In the presence of dye wastes in sewage residual chlorine may be determined by the spot plats, method employing ortho-tolidine, if the dye should be sufficient to interfere with the comparator method. Usually, when residual chlorine was present the dye waste lost most of its original color and the color change might itself serve as the index of ample chlorine applied.

Operator Licensing

An experience was reported which may lead to better things—namely, the placing of sewage operators under Civil Service in New York State. At Lackawanna the plant superintendent was replaced along with four others. The position was given to a man having no previous sewage experience. To circumvent legal complications the new City administration paid these men $1.00 per year, which necessitated their resignation. The new administration claimed they had not been "let out." The State Department of Health took the matter up with the Lackawanna authorities, but has been unsuccessful in getting the salaries reinstated. The matter has been referred to the Attorney General.

[All of this may have a very important meaning, since the Attorney General's Office is looking into the propriety of placing sewage works operators under Civil Service throughout the State. If that be the answer it is much stronger than any licensing scheme could possible be. From this point on it may prove that the "by-product" from the N. Y. licensing regulations may prove more valuable than the original product. Let's hope that something comes of this wishful thinking.—ED.]

CONGRESS AUTHORIZES OHIO AND POTOMAC RIVER COMPACTS

Represents First Intrastate Anti-Pollution Covenants

By JAMES G. ELLIS
Washington Correspondent

TWO interstate compacts aimed at pollution abatement in the Ohio River and the Potomac River basins, the first anti-stream pollution covenants ever to receive Congressional approval, were approved by the House of Representatives on July 1. The Senate had previously put its stamp of approval on both compacts.

The first, which creates the "Ohio River Valley Water Sanitation District," includes Illinois, Indiana, Kentucky, New York, Ohio, Pennsylvania, Tennessee, and West Virginia as signatory states. The second establishes the "Potomac Valley Conservancy District" and will become effective when the states of Maryland, West Virginia, Pennsylvania, Virginia and the District of Columbia finally ratify its provisions.

While the two compacts are similar in many respects, with the administrative agencies empowered to make studies, advise, cooperate with other agencies, and disseminate information on the harmful and uneconomical results of stream pollution, the "Ohio River Valley Water Sanitation Commission" is given the power to institute court action for the enforcement of its orders. Advocates of stream pollution legislation in Congress hailed the action as an important forward step irrespective of whether or not the pending Barkley stream pollution bill ultimately becomes law. They emphasized, however, that the interstate compact method can not be considered a substitute for the Barkley bill now held up in Conference Committee, but rather supplements the provisions of the measure.

Ratification by Pennsylvania, West Virginia and Virginia, satisfying the qualifying conditions stipulated by Ohio and West Virginia will make the Ohio River Compact finally effective, now that Congress has given its approval, New York, Illinois, Kentucky and Indiana having already ratified.

Under the terms of the Ohio river compact, the signatory states (1) pledge faithful cooperation in the control of future pollution and in the abatement of existing pollution; (2) agree to enact any necessary legislation to enable each state to place and maintain the waters of the basin in a satisfactory sanitary condition, "available for safe and satisfactory use as public and industrial water supplies after reasonable treatment, suitable for recreational usage, capable of maintaining fish and other aquatic life, free from unsightly or malodorous nuisance due to floating solids or sludge deposits, and adaptable to such other uses as may be legitimate"; (3) create the "Ohio River Valley Water Sanitation District embracing all territory within the signatory states, the water in which flows ultimately into the Ohio River, or its tributaries"; and (4) set up the Ohio River Valley Water Sanitation Commission to consist of three commissioners from each state and three commissioners representing the United States Government.

Specifically, the compact provides that all sewage from municipalities or other political subdivisions or corporations within the area "shall be so treated within a time reasonable for the construction of the necessary works as to provide for substantially complete removal of settleable solids, and the removal of not less than 45 per cent of the total suspended solids. . . ." If the commission determines after investigation, due notice and hearing that a higher degree of treatment shall be used in order to protect the public health or to preserve the waters for other legitimate purposes, it can so direct.

In addition to conducting surveys, preparing reports, and recommending uniform anti-pollution legislation, the commission after investigation and reasonable notice and hearing is empowered to issue an order upon any municipality, corporation, person, *or other entity* discharging sewage or industrial waste in the area, and may prescribe the date on which such discharge shall be wholly or partially discontinued, modified or treated or otherwise disposed of.

The compact imposes a duty upon the affected municipality, corporation or person to comply with the Commission's order, and any court of general jurisdiction or any United States district court in any of the signatory states is given jurisdiction to enforce the Commission's order.

The machinery to administer the Potomac Valley compact is identical in many respects to the administrative set-up for the Ohio River compact, except that the Interstate Commission of the Potomac River Basin is not authorized to issue orders. It can only issue "recommendations" without powers to enforce such.

CALIFORNIA SEWAGE WORKS ASSOCIATION HOLDS CONFERENCE ON CATALINA ISLAND

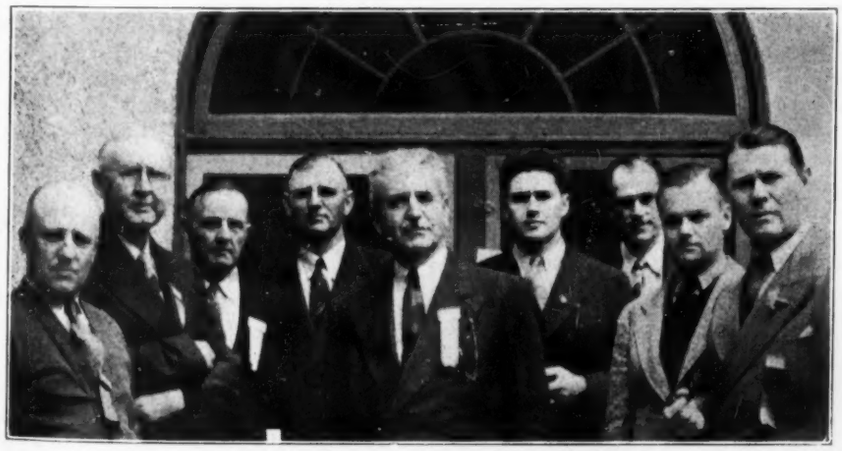
St. Catherines on Santa Catalina.

As Reported by
A. M. RAWN
Associate Editor*
LOS ANGELES, CALIFORNIA

MORE than a hundred members and guests of the California Sewage Works Association met at the St. Catherine Hotel, Santa Catalina Island, May 19, 20 and 21, to participate in the Association's twelfth annual spring conference. Embarking on the "Avalon" at Wilmington on Sunday morning the 19th, the group reached Catalina about noon and enjoyed the recreational facilities of the beautiful summer resort during the afternoon, included in which was a golf tournament over the Island's extremely sporty course. In the evening attention was focused upon General Electric Co.'s interesting motion picture of the Columbus plant in color film. E. C. Kite presented the accompanying talk.

Following a 7 o'clock Directors' breakfast on Monday morning, technical sessions carried through the day to conclude with the annual conference banquet and an inspirational address upon "Beautiful Mud," by W. Ballentine Henley, Director of Public Speaking at the University of Southern California. Mr. Henley wove what he called the cable of civilization made up of strands of literature, science, medicine and religion; and then commented briefly upon the situation into which the world has developed today, issuing a note of hope in the statement that the chaotic world condition which we view so seriously now is but a counterpart of many occasions in the past, only on a larger scale and with an accelerated tempo.

"A. M."



C. S. W. A.'s Official Family

From the left: Harold F. Gray, 1st Vice Pres.; J. F. Byxbee, Director; Fred D. Bowlus, 2nd Vice Pres.; Carl F. Tennant, Director; The President, H. G. Smith; Wm. T. Ingram, Sec'y-Treas.; B. D. Phelps, Director; A. Carl Beyer, Rep. on Federation Board of Control; H. W. Jewell, Director. [Missing from picture—Prof. Chas. Gilman Hyde, Rep. on Federation Board of Control, and Director Alexander Bell, Immediate Past-President.]

Technical sessions were concluded at noon Tuesday the 21st, the group returning to the mainland on the afternoon boat.

The Question of a National Sewage Works Association

The Board of Directors discussed at length the matter of operators' schools within the State, as well as the need for a national sewage works association. As to the former, it was decided to continue to hold the biannual school in the South at the University of Southern California and suggest to Northern Californians that they divide their area into small districts, establish a conference group in each, and attempt to take the instruction to the small plant operator rather than ask him to leave his duties and attend a central northern school at the University of California.

Concerning the question of the desirability of the California association becoming a unit of the proposed national association, no conclusion was reached, it being considered advisable first to have a committee study the problem more thoroughly and canvass the membership as to its wishes between now and the Fall meeting scheduled to be held in September.

Operators' Breakfast

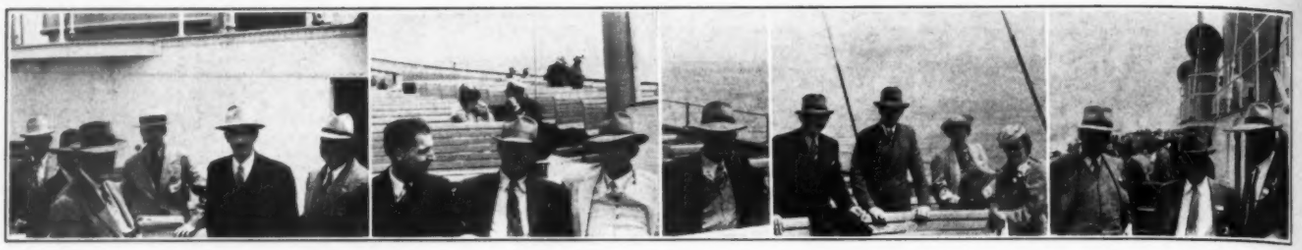
A regular feature of the meeting, the Operators' Breakfast held the morning of the first day, was presided over by William A. (Bill) Allen, Superintendent at Pasadena. Topic—

"Withdrawal of Sludge from Primary Sedimentation Tanks"

Ben Benas (San Francisco), in part stated that his experience indicated a definite relation between sludge withdrawal and effluent qual-

* Asst. Chief Engineer, Los Angeles County Sanitation Districts.

Ed. Note: Although Mr. Rawn's report reached us in time for use in our June issue, it unfortunately had to be held over because of the considerable number of pages already allotted to reports covering earlier meetings.



Aboard the "Avalon" enroute to Santa Catalina

(1) J. B. West (San Leandro); Ben Benas (San Francisco); C. L. Towers (Calif. Fish and Game Com.); Carl Beyer (Wallace & Tiernan Co.); Paul Shaw (Calif. Fish and Game Com.); Fred Post (Lodi)—(2) A. A. Apple, J. C. Clark and A. J. Castro, Jr.—(3) B. D. Phelps (San Diego), who will be host to Fall meeting—(4) Wm. A. Allen (Pasadena); "Jeff" Smith and Mrs. S. (San Francisco); "Al" Frick (Los Angeles—(5) Adolph Koebig (L. A.); "Ed" Wagner (Los Angeles); D. R. Kennedy (Long Beach).

ity. *V. C. Johnson* (Covina) said that withdrawal of sludge at his plant was regulated by electrical time clock to short periods of pumping at frequent intervals. *A. E. Fiscus* (Los Angeles Terminal Island Plant), noted that the time clock regulating sludge withdrawal at his plant was set to synchronize with the subsidence tank sweeps, thus withdrawing from the basin the thickest and best-compacted sludge only. Discussion then drifted to difficulties encountered in emptying digesters, and led to the examination of a gadget built by *J. C. Clark* comprising tongs for the removal of ball check valves used in sludge pumps, and concluded with a resolution to determine whether or not the sale of digested sludge requires a fertilizer manufacturer's license.

Technical Sessions

(President H. G. Smith Presiding)

"A History of the Sewage Situation, Both Ancient and Modern," by HAROLD F. GRAY, Consulting Engineer, Berkeley.

Mr. Gray said, in part, that few achievements in modern sanitation are overly remarkable when viewed in the long historical perspective. Over four thousand years ago a high degree of sanitary attainment had been reached. This was later submerged by wars and other disasters, partially restored by Rome, again lost in the Dark Ages and the Renaissance, and only in the last 100 years regained to any appreciable extent. An ancient civilization in India, about 2550 B.C., achieved effective sewage handling, a fairly well protected water supply, and baths. Ablution places were adjacent to the privies, thus greatly antedating one of our most modern of public health practices. In Crete, from 3000 to 1000 B.C., the Minoan civilization developed independently a high degree of sanitation; and even today the drains in some of their structures operate perfectly. They developed burned clay drain pipes and bath tubs much like our own. These civilizations were not unique; they could be matched by others in the Mesopotamia and elsewhere. In extent they were superior even to the Roman efforts.

From the Fall of Rome until the middle of the last century, mankind blundered pitiably in the problem of disassociating himself from immediate juxtaposition to his excrement. The record of the Middle Ages is sad, laughable and curious and is punctuated with epidemics. [And, we might add,—epidemics cloaked by religion.—ED.]

Even in the last hundred years our progress has been slow, lacking in continuity, and frequently retrograde. It was not until 1842 that London even began to catch up with the Minoans, and their bungling efforts at first only succeeded in transferring the whole mess to the Thames, with the resulting "great stink" of 1858-59 —the first time that an odor was elevated to the rank of an historic event! Since then a certain amount of proggestions based upon a long and intiress has been made, especially in our understanding of the complex phenomena of organic chemistry and bacteriology, which are basic to an understanding of the problems of sanitation; but it is a matter of regret that too frequently this progress has been localized only, or inadequate.

"Maintenance Methods—Los Angeles City Sewer System" by REUBEN F. BROWN, Assistant Superintendent, Sewer Maintenance, Los Angeles.

The sewerage and storm drain system of Los Angeles comprises 2,794 miles of sewers; 11,599 flushing structures; 630 miles of storm drains; 26,200 catch basins; 632 culverts; 18 pumping stations; one storm water pump station, and the Nation's largest sewage screening plant involving fine screening. Costing about $65,000,000 and serving a population of 1,500,000, the system is operated and maintained by a force of only 134 men, divided into 29 well-equipped field crews. The cost for inspection, cleaning and replacements was reported to be $20.06 per mile for sanitary sewers, and $71.62 for storm drains.

Mr. Brown's paper, profusely illustrated with slides, covered all phases of operation and maintenance work from the newest equipment and methods used to a discussion of the common as well as unique reasons for sewer trouble. His paper is replete with essential data and contains a wealth of valuable advice and suggestions based upon a long and intimate acquaintance with the difficult task of keeping a large city's sewers

(1) Prof. Franklin Thomas (Cal. Tech)—(2) Prof. A. P. Banta, (Calif. Tech), Dr. Richard L. Pomeroy, Research Chemist and Carl F. Tennent, Plant Supt., Los Angeles County Sanitation Districts—(3) A. A. Apple, E. G. Studley, Sanitary Engr., and R. F. Brown, Ass't Supt. Maintenance, Los Angeles Bureau of Sewers—(4) C. L. Towers and Paul R. Shaw, Calif. Fish and Game Commission—(5) Dr. H. K. Palmer of Los Angeles.

open and operating at all times. The speaker closed his remarks with a special plea for uniform and more adequate sanitation records.

Following Mr. Brown, F. D. Bowlus, Resident Engineer, Los Angeles County Sanitation Districts, related similar data for the Districts' system, stressing the use of water-propelled hoes, disks and partially deflated beach-balls as methods of cleaning. Mr. Bowlus devoted much of his discussion to measurement of H_2S concentration in sewers and told of the District men's experience with this deadly gas in toxic concentrations. He touched briefly upon sulphide control measures, including chlorination, ventilation and the use of ammonia gas in the atmosphere.

"Interpretation of Laboratory Records" by RICHARD D. POMEROY, Research Chemist, Los Angeles County Sanitation Districts.

Dr. Pomeroy, in part, stressed the fact that much has been said about the value of routine tests in the operation of sewage treatment plants, but too little about the importance of care to be exercised in selecting tests; also, in eliminating unnecessary tests which have long ago ceased to show anything of value; and, further, in interpreting data assembled by testing. The net result: shelves stacked with dusty records in some plants, while in other plants there has been a dearth of data which is really needed.

Said Dr. Pomeroy—"The operator must not judge the value of tests solely by the aid they may give him in operation. Data which may not be of value to the operator may be needed by the engineers, and may contribute to the general fund of knowledge about the performance of treatment plant units. The operator should be able to make a variety of tests, but should make them only as frequently as necessary for specific purposes. Further—"Often the operator is in need of chemical advice to to what tests to make, and the significance of the results. In the case of many industrial wastes, and certainly in the case of odor problems, expert chemical advice is essential if economical answers are to be found."

"The Sewage Situation of the City of Los Angeles" by PROFESSOR FRANKLIN THOMAS, California Institute of Technology, Consulting Engineer.

In 1883 when Southern California was experiencing a period of drouth, the city sold sewage to produce farms in the vicinity of Inglewood at $2.00 per acre-foot. The sewer extended only that far. By 1895 the flow had increased and a new contract was entered into with the irrigation company for a little over 6 cu.ft. per second. Public criticism forced the abandonment of this means of disposal, and in 1906 the central outfall extending to the ocean at Hyperion was built. Constructed as a brick arch, it had a capacity of 90 cu.ft. per second, was ten miles in length, terminated in a wood-stave pipe built upon a trestle and extended 2,000 ft. to sea. By 1921, pollution of the adjacent beach had reached proportions which drew the criticism of the California health authorities; and at that time Fuller, Whipple and Mulholland, acting as a consulting board, recommended a new line to the sea and a submarine outfall with a capacity approximating 400 cu.ft. per second, to cost $12,500,000. Bonds for this structure were defeated, but heavy rains during the winter so aggravated conditions, both in the vinicity of the outfall and throughout the metropolitan area, that when the bonds were presented again in 1922 they carried four to one.

Ted. Gregory, Construction Engr., Los Angeles; J. F. Byxbee, City Engr., Palo Alto, Calif., and E. C. Kite, General Electric Co.

A. E. Fiscus, Supt. Terminal Island Plant, Los Angeles, and H. F. Gray, Consulting Engineer, Berkeley.

The present necessity for a new sewerage system for the City develops from a badly fractured semi-elliptical unreinforced section of outfall sewer leading to the sea, and a reinforced concrete submarine outfall line which appears to be beyond repair. A consulting board comprising engineers Thomas, Hyde and Greeley, reporting upon the situation for the city, recommend extensive repairs to the semi-elliptical outfall, replacement of the present Hyperion screening plant with subsidence works and separate sludge digestion, and a new ocean outfall. In the matter of future extensions, construction of oxidation plants are proposed at strategic points above and throughout the city.

Statistically, Mr. Thomas said, upon reaching the ocean outfall at Hyperion, 95% of the sewage was at least 3 hours old, 50% at least 5 hours, 20% at least 7; and the oldest sewage in the line, 18 hours. The oldest sewage originates at Canoga Park, 52 miles from the Hyperion screening plant. He cited the population increase in the city between 1880 and 1940 as being from 11,000 to in excess of 1,400,000 at present, and said that any design must be sufficiently flexible so that Los Angeles could continue her good-neighbor policy in the disposal sewage from neighboring small communities.

Commenting upon Professor Thomas' paper, Professor Charles Gilman Hyde of the University of California (a member of the Consulting Board), said that he felt there was no single or simple solution to a problem of this magnitude; that many solutions were possible and only the greatest care in the examination of all would lead to the final correct conclusion. He stressed the necessity for securing enough money to do the job well.

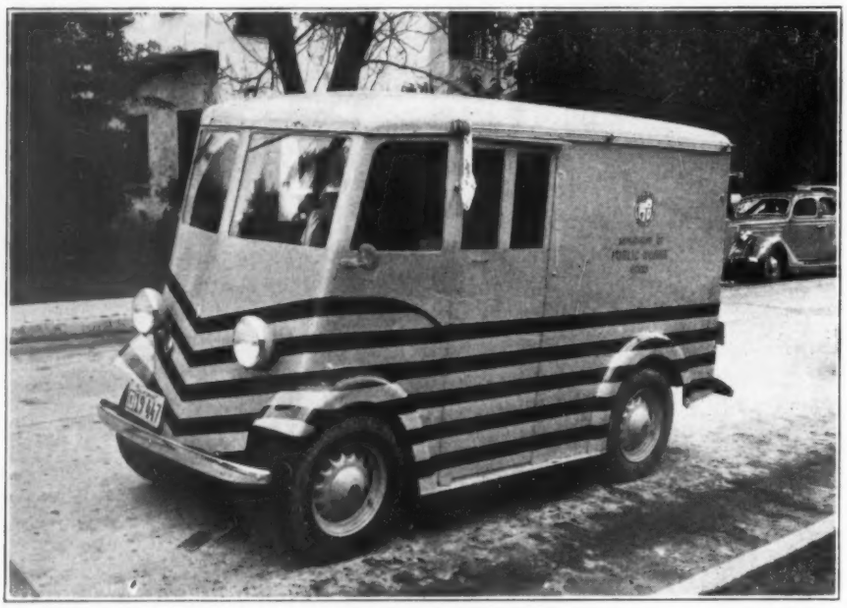
"Combating Pollution in Stream and Ocean Waters" by PAUL R. SHAW, California Fish and Game Commission.

After citing the general provisions of the Fish and Game and Federal laws in the State of California, Mr. Shaw tendered the Commission's thanks to the Federal Government for the invaluable aid rendered by the Coast Guard and the Army Engineers, stating that the harmony which existed between State and Federal departments had proved an invaluable aid in policing ocean and stream waters. After directing attention to the toxic qualities in oil, ore, and hydraulic mining wastes, Mr. Shaw stated that lumber mill wastes accounted for much of the difficulty in

the short California streams; and then said that the Commission was anticipating a nice problem in the regulation of acid mine wastes in the narrow arms which will be flooded upon completion of Shasta dam. He said that "still slops" from wineries within the State are being successfully treated by chemical precipitation, involving lime, and the clarified effluent applied to trickling filters. Unfortunately, the cooperative effort between wine growers and the Commission received a set-back during the election year of 1938, and that in the year of retrogression, foul conditions developed which acted as a stream barrier to salmon spawning. However, in 1939, regulatory measures were reinforced, the situation cleaned up and the salmon spawning is being investigated, present indications being that it could be coagulated with sulphuric acid and its pollutional load reduced 70% thereby. He said that in San Francisco Bay during the peak of the season, the "stick water" had a population equivalent of 5 million. In closing, he recommended a central State agency for the most effective control enforcement.

"State Requirements Relative to Electrical Equipment in Pumping and Treatment Plants" by FRANK A. SHORT, Engineer, State Accident Commission.

Mr. Short quoted from the National Electrical Code the safety measures prescribed in 1934 and subsequently revised, stating that while



The City of Los Angeles Special Truck
Employed in Continuous Survey of Sewers for Explosive Gas as Part of Maintenance Program.

head waters re-opened. In respect to an effective means of disposal of celery wastes, which have been a fresh-water disposal problem, Mr. Shaw said that waste troughs built through the packing sheds carried the waste celery to a disposal area where it was delivered to a cattle feed contractor. Paying fifty cents a ton for it the contractor resold it for $2.00.

Concerning fruit canning wastes, Mr. Shaw said that practically all fruit cannery wastes will be eliminated from river waters in Northern California by 1941, due largely to regulatory measures and the cooperative efforts of the cannery people. He then noted that all bilge water from the purse seiners in San Pedro and Wilmington waters is now disposed of into the city sewers, and that "stick water" from the fish canneries sewage pumping plants and stations were not specifically included, the Commission and the National Fire Protection Association felt that they could be classed within the scope of hazards which the Code defined. He then cited four instances in California upon which the opinion in this State rests: (1), an explosion in a dry well where the operator failed to start a fan before striking a match; (2) where it was said kerosene had been used to clean filth from a pump; (3) relating to an explosion of sewer gas ignited by a welder nearby; and (4) still one more due apparently to bad ventilation. The remainder of his citations outside of the State related largely to explosions in sewers. Mr. Short left his listeners with the feeling that the case for complete isolation of all electrical switchboards, starting equipment and the like, from the rest of the plant was a little hazy and that the citations were not especially convincing as to the need for so doing.

Covina's Complete Plant

"The New Covina Sewage Treatment Plant" by TED GREGORY, Construction Engineer.

This plant, Mr. Gregory stated, was designed for an ultimate population of 5,000; that 3,200 people now reside within the city limits; and that of a possible thousand connections to the sewer, 150 are installed. The plant is designed for primary subsidence, separate digestion and high rate trickling filtration, involving recirculation of a portion of the effluent from the primary filter; secondary subsidence and second stage trickling filtration; thence to a third combination subsidence and coagulation tank, and finally to sand filters. The final disposal consists of chlorination and use as irrigation water, or delivery into deep wells for percolation to the underground strata. From an initial B.O.D. of 220 parts per million, reductions are to 55 B.O.D. through the first stage. A further reduction to 21 B.O.D. is effected in the second stage, and the final B.O.D. approximates 5 p.p.m. only. The plant, which has been in operation about one year, was built with a P.W.A. loan and grant and cost about $100,000. Its location required especial care in planning for odor free operation and completeness of disposal.

Maintenance and Operating Problems

(A Round-Table)

"Sewer Maintenance in the City of San Diego" by R. D. PHELPS, Engineer of Sewers, San Diego.

Mr. Phelps stated that while the use of a solid, unyielding joint material may be excellent insurance against root penetration, it is not so good for a yielding trench base under ordinary loading conditions. He called attention to many sewers built in the rocky soils in and about San Diego, and stated that the roots of adjacent verdure would follow the backfill, surround the somewhat permeable pipe, gradually shove it offline, crack the bell and thus gain entrance to the pipe interior. He described a root 60 feet in length which had entered through a ¾" hole left in a manhole where a ladder step had been removed. Phelps then described methods for removing roots and said that a copper wire, wound around the

spigot of a pipe where it enters the bell, had sometimes proved toxic to roots which penetrated at that location.

Carl Hoskinson (Sacramento) said that his city of 121,000 population had 250 miles of combined sewers, operated with a single crew comprising one foreman and eight laborers. He said there were few roots penetrating into the lines in streets and alleys and that most of their root trouble is in private rights of way. The city sewage is now discharged raw into the Sacramento River, although plans are under way for a complete rehabilitation of the sewage disposal facilities. He humorously described situations which frequently developed in pumping when someone throws inner tubes into the sewers and they get into the pump impellers. He also said that a set of false teeth, removed from the bar screen and advertised in the paper as a news item, were claimed by six individuals and finally returned to the one whom they fitted!

A. E. Fiscus, operator at the Terminal Island Plant (Los Angeles), discussed "Gadgets." He described the method of timing sludge removal to synchronize with the approach of the sweeps, stating that by this means he was able to withdraw sludge with less than 92% moisture. The odors from the launders in the primary clarifier are trapped and burned with digester gas. He then described the method of pumping septic sludge with a 24″ vacuum on the suction side by continuously exhausting the gas from the sludge through a riser pipe before the sludge entered the pump. He concluded with the statement that the electrolysis of metal portions of the digestion tank, which had proven destructive in the past, is now being completely controlled by cathodic protection.

C. F. Tennant, Superintendent, Joint Disposal Works, Los Angeles County Sanitation Districts, prefaced his remarks with the statement that there is a streamlined cooperation between engineers and operators — humorously stating that "We can break down anything you fellows can build!" Regarding sludge drying, Tennant stated that the best method for this area is undoubtedly open air drying. He said that if drying sludge is rained upon it produces a bad odor, but that such may be "dampened" out by blanketing it with another dosing of sludge. He then said that excellent drainage and drying conditions can be had without underdraining by constructing the bed on a slope of 2″ per 100 feet, permitting the entrained water to leave the sludge and flow ahead of it as the bed is filled. The remaining water is removed by evaporation.

R. D. Woodward, operator of the Activated Sludge Plant at Laguna Beach, said that in its preliminary shakedown it developed that there was not enough air supplied with the four Water Works Supply Company mechanical aerator pumps; that in a readjustment of conditions he had remodeled all of the piping, both inlet and outlet, to the pumps and by so doing had increased the air from 12 to 30 cu.ft. per minute per aerator, at the same time reducing the horsepower requirements from 7.4 to 5.8 per unit. Reduction in horsepower is accounted for by the increase in inlet and outlet diameters. The siphonic action at the inlet air jet accounts for the increase in air supply. He stated that although the plant had not yet gone through a summer season in its new condition, he felt reasonably sure that it would operate satisfactorily under the heavy summer loads.

Jack Kimball, City Engineer's Office, speaking for the plant at Palo Alto, said that they were still having considerable difficulty with the digester, as a result of the heavy seasonal cannery load. The plant commenced operation in July, 1934. By July, 1935, eight feet of scum had collected in the digester, which increased to 12 feet by fall. Various methods, including pumping the scum to an adjacent field, were employed; and finally (1939) the system of breaking up the scum by raising and lowering the water surface was devised which did pretty well. The merit of this plan is not decisive because of other difficulties. Discussion following Kimball's remarks developed the fact that tomato skins will neither digest nor sink to the bottom of the digesting mass, even after several years in the clarifier.

Los Angeles' Pilot Plant Proves Splendid Investment

"Experiments Conducted at the Pilot Plant of Los Angeles City" by E. G. STUDLEY, Sanitary Engineer, City of Los Angeles.

Mr. Studley stated that when the City Engineer's office had concluded that the screening plant at Hyperion must be abandoned, a number of plans were prepared, some utilizing the old structures and some otherwise. All have now been abandoned in favor of a plant which will incorporate flocculation with subsidence, and disposal of the effluent through a submerged outfall line. Sludge digestion will involve a combination of mesophilic and thermophilic digestion. In order to demonstrate the merits of the latter, the pilot plant was constructed by the City under Mr. Studley's direction. It has demonstrated digestion characteristics which would indicate a saving of more than a million dollars in plant construction; that by combining thermophilic first, followed by mesophilic digestion, odors were controlled and the sticky, refractory thermophilic mess reduced in consistency to that obtained by normal mesophilic digestion. He stated that over a 20-month period of operation it had been demonstrated that this combination treatment will result in digestion tank capacities equating to 12 lbs. of dry solids per cu.ft. of capacity per month. He stated further, even without chemicals, flocculation followed by one hour's plain subsidence would result in a removal of about 65% suspended solids from the Los Angeles City sewage.

"The Care of Motor Bearings" by GEORGE BEST, Agent, General Electric Company.

Mr. Best said that his company had recently developed a cartridge type of ball bearing which could be cleaned by forcing grease through it. He said that as many bearings were destroyed by compacting too much grease in and about the balls, as the number that fail because they are dirty. He gave most ball bearings an average life of about two years and said that while they probably did not need lubrication at any time during their life, or at least more than once a year, with the new cartridge type they should be flushed out with grease every three months. Mr. Best distributed pamphlets containing much valuable information relative to the general care of bearings, and a thorough description of the new type G.E. bearing discussed.

The Fall meeting is scheduled for September in San Diego.

Klevenow Made Milwaukee's Supt. of Distribution

Reinhold Klevenow has recently been made Superintendent of Distribution at Milwaukee, Wisc.

Mr. Klevenow has served the Milwaukee Water Department for 28 years and succeeds Mr. F. M. Fitz, who recently retired.

The announcement was made by Henry P. Bohman, General Superintendent.

SNAPPED AT THE SPRING MEETING OF THE MAINE WATER UTILITIES ASS'N.

Poland Spring, Me., June 12, 1940

THE snapshots below were taken during the June meeting of the Maine Water Utilities Association which, with the contingent of guests from the New Hampshire Water Works Association, constituted a record meeting attended by 178.

At the Technical Session the following papers were given: "Water Works Practice News" (Illustrated) —Linn H. Enslow, Editor WATER WORKS AND SEWERAGE; "Insurance Practice of the Portland Water District"—J. Arthur Jackson, Asst. Treas., Portland Water Distr; "Steel Painting and Wood Preservation"—E. Bizzozero, E. & F. King Co., Boston; "Dealing With Domestic Cross Connections"—Arthur Harrington, Mass. Dept. of Health, and Mr. Murphy, Water Dept., New Bedford, Mass.

Travelled Greatest Distance.
Left: The J. N. Mullens, of Houlton, Maine. Right: The W. H. Daniels, of Hudson, N. H. (Their reward—free dinners.)

Officers of the Two Associations.
Presidents—"Dave" Moulton, Atty. Portland Water Distr., Portland, Me., and Percy Shaw, Sup't. of Water, Manchester, N. H.
Maine's Editor, "Sid" Anthony, explains the fine points of an exposure meter.
Secretaries—Earle Tarr, Sup't. of Water, Winthrop, Maine, and Leonard Trager, N. H. Dep't. of Health, Concord, N. H.

(1) "Fred." Reny, Gen'l. Mgr., Portland Water District and Geo. A. Caldwell, Mattapan, Mass., facing the camera (No. 3 is a blank)—(2) "Prexy" Moulton explains something-or-other (but to whom?)—(3) Ernest Bizzozero, of E. F. King & Co., Boston, read a paper on Steel Painting and Wood Preservation.—(4) "International Water Works"—from this spring house Poland Spring water is distributed the world over.—(5) Horace Clark, Sup't., Sanford, Me.; Francis Hatch, Sup't. Kittery, Me.; J. M. Rose, Johns-Manville Co., Boston.—(6) The Prestcott Twins of H. R. Prestcott & Sons, with their demonstrating "Flexible Water Main and Sewer Cleaning Truck.

THE WATER TREATMENT MANUAL OF A.W.W.A.

The long looked for and much needed "Manual of Water Quality and Treatment" of the American Water Works Association is now a reality. It is an illustrated book of 300 pages, representing a revision and amplification of those sections of the Association's original "Manual of Water Works Practice" published in 1925. In consequence, the new Manual, wholly devoted to water quality, methods of treatment, and purification processes, represents a considerable amplification. It is right up to the minute in the newer developments, and covers all that has been proven worthy in water purification and quality control during the 15-year interval since the chapters of the 1935 Manual were developed.

The new edition has been completely rewritten by experts, chosen from the country at large to serve on the revising committee. The assembling and rewriting of contributed material represents the work of Mr. Paul Hansen of Chicago, in the first phases, and that of the late Professor Lewis V. Carpenter, of New York University, in the closing phases. The final arrangement and editing represents the work of Harry E. Jordan, Executive Secretary and Editor of A.W.W.A.

The new Manual, representing as it does the best opinions of the several contributing experts, and the critical reviewing experts, is in reality the last-word in water treatment practices. Its outstanding point of merit is the condensation of material, plus its up to dateness in text found in the following chapters:

Chapter	*Topic*	*Pages*
I	Available Water Sources	6
II	Organisms in Waters	6
III	Standards of Quality	34
IV	Natural Purification Effects (Streams, Lakes, Reservoirs)	23
V	Pre-Treatment in Filtration (Algae Control, Aeration, Mixing)	42
VI	Coagulants and Coagulation	21
VII	Chlorination and Ammoniation	28
VIII	Taste and Odor Control (In addition to methods in other chapters)	8
IX	Filtration (Sand Specs., Underdrains, Washing, etc.)	35
X	Water Conditioning (Softening, Corrosivity Correction, Iron and Manganese Removal)	52
XI	Treatment Control (Laboratory and Plant)	8
XII	Bibliography (177 Basic References	8

Our present statement is to be considered more of an announcement than a critical review or analysis. The latter can only follow after the publication has been sufficiently long in the hands of users or critical reviewers. To date, however, we have heard nothing but praise for this work, which has been badly needed and will serve a highly useful purpose; and, more the pity that circumstances made for delays in its appearance beyond control of the Association.

The Manual is purchasable *only* through the A.W.W.A. Office—22 East 40th St., New York City. The price—

To Members of A.W.W.A. $2.50
($2.25 if payments accompanies order)
To non-Members $3.00
(This work will keep alive the memory of Lewis Carpenter, and does credit to his collaborating contemporaries.—L. H. E.)

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Officials everywhere agree that DIAMOND Liquid Chlorine is "tops"—and they offer many reasons for their choice. Some say it is Diamond's unfailing purity; others choose Diamond Liquid Chlorine because of its uniformity; to some operators, Diamond's Scheduled Delivery Service is a source of great comfort. But the whole story can be pretty much summed up in the single word "DEPENDABLE".

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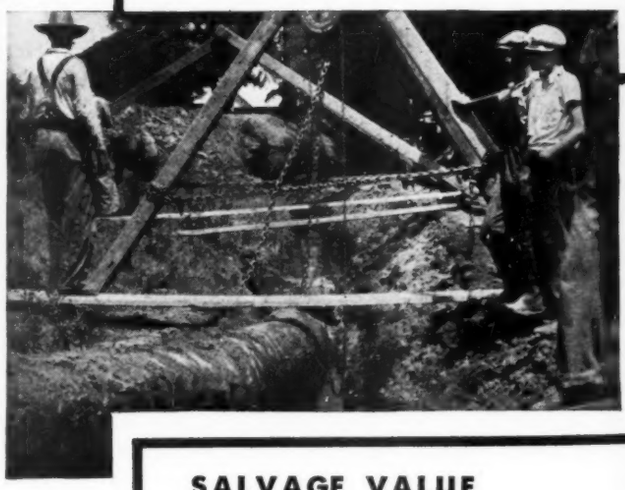
writes:

LOW MAINTENANCE

is an economy factor in cast iron pipe that is usual, rather than exceptional, in water works experience. An impartial survey among nearly 200 water works superintendents shows that the maintenance cost of cast iron pipe is far below that of any other pipe material which has been in use long enough for the recording of conclusive data.



LONG LIFE

Above is reproduced an unretouched photograph of a cast iron water main which has given faithful service to the taxpayers of the City of New York for more than 100 years—a service record unmatched by any other water main material.

Look for the "Q-Check" registered trade mark. Cast iron pipe is made in diameters from 1¼ to 84 inches.

SALVAGE VALUE

Photograph shows removal of an 18-inch cast iron water main to be salvaged and re-used at Athens, Georgia after nearly a half-century of service. Another instance of the final economy of cast iron pipe expressed in salvage value.

Thrift

1 Official records of cast iron pipe laid 100 to 200 years ago and still in service, prove that cast iron pipe is

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2 Reports from 195 waterworks superintendents, tabulated and attested by a nationally-known independent statistical firm, prove that cast iron pipe is

LOWEST IN MAINTENANCE COST PER MILE PER YEAR

3 When mains must be abandoned, relocated or replaced by larger pipe experience proves that cast iron pipe has

HIGHEST SALVAGE AND RECLAMATION VALUE

Algae! the unseen enemy

With the hot summer weather well on the way, waterworks men must be on the lookout for tastes and odors in water supplies.

All that is necessary for algae to grow is water and light. However, they do thrive more profusely under warm temperature conditions so that every plant operator should be alert for the first signs of tastes and odors from this source. Warm weather also facilitates the decomposition of organic matter in water supplies and there is always associated with this decomposition an objectionable taste and odor which must be corrected.

At this time of year rainfall is usually not plentiful and from now on through the summer low stream flows and low water supplies can be anticipated. These low water supplies can result in tastes and odors from industrial wastes, decomposing sludge, silt, etc.

AQUA NUCHAR Activated Carbon has been demonstrated conclusively to be the most effective means of eliminating tastes and odors from water supplies. Check your stocks now and make sure that you have an adequate supply of AQUA NUCHAR on hand to take care of tastes and odors which are on their way.

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THE KANSAS CITY CONVENTION OF A.W.W.A.

(Final Installment)

Management and Corrosion Control Featured on Program of Plant Management Division and in General Sessions

THIS is the third and final installment of the report covering the impressive record setting 60th Annual Convention of the American Water Works Association held April 21-25th in Kansas City, Mo.

The first installment (May) comprised a general report of the convention and the opening Technical Session. The second installment (June) comprised a digest of papers presented before the Water Purification and the Finance & Accounting Divisions. This final installment comprises a digest of papers presented before the Plant Management Division and as many of those presented in the General Sessions as proves permissible. It will likely prove impossible to do justice to all of the papers, not previously covered, in the space available for this final installment. Rather than skimp on what are believed to be the papers of greatest interest to the greatest number of our readers we consider it wisdom to use the space accordingly. This may entail no more than the listing of titles of those topics which we are unable to effectively report in the digest style employed, as contrasted to the coverage of *all* papers by employing shorter and less interesting abstracts, which leave much to be desired in the minds of most readers. This in no wise infers that those papers listed at the end are not worthy contributions to be found later in the Journal of A.W.W.A. It only means that, to the majority of our readers, we consider the papers covered herein are of more immediate concern or general application.

With this explanation to those authors who may feel slighted through failure to find their papers given equal space to others, we shall proceed and pray their indulgence, considering that this policy is in line with the wishes of our readers—and, possibly, including some of these same authors.

Management Division Chairmen (Outgoing and Incoming)

A. P. Kuranz
Supt. of Water
Waukesha, Wisc.

L. S. Vance
Supt. of Water
Louisville, Ky.

Management Patterns

One complete session was given over to papers and discussion dealing with organization and experiences with various types of management of publicly operated water utilities. The opening review was by an engineer who has had contact with many types of management — both public and private.

"The Engineer Looks at Management," by ROBERT E. MCDONNELL, Burns & McDonnell Eng. Co., Kansas City, Mo.

Mr. McDonnell said that at present all but about 20% of the existing 12,500 water works systems in the United States are now publicly owned, but there should be no distinction insofar as effectiveness of management is concerned. Profits from the municipal plant should all be returned to customers in the form of "dividends" in advance—namely, in rate lowerings. That, basically, should be the one chief distinction between municipal and private operations and management.

A survey in 1938 by Mr. McDonnell revealed that in the 2042 communities of 3000 population and larger, 827 systems were privately owned—i.e., roughly 40% as compared to the average of 20% for all of the 12,500 systems.

The speaker was of the opinion that one principal item upon which the public judged the management and operation of all water systems was first of all the matter of water quality more than rates or pressures. In consequence more money and effort than ever in history before is being put into correcting odors, tastes and corrosivity of water, in addition to hygienic safety under all circumstances.

In financial management it was surprising that appraisals of property value and inventory of yard supplies, equipment and stores, was so generally neglected in comparison with current operating costs. No other business could be run on such a basis of ignorance of present property worth, and depreciation or appreciation.

In evaluating types of management of publicly owned systems the most universally satisfactory and economy productive procedure had been through management under a Utility Board with members serving overlapping terms, making possible continuity of experience and consistent policies. Particularly advantageous had been such Boards under which came more than one municipal utility.

Surprising as it seems, rate schedules for water, one of the most important factors in management, show astounding variations and for the most part are lacking in scientific basis. In the 11 largest cities of the U. S., average charges for metered water per 100 cu.ft. varies from 5.1 cents in Chicago to 25.8 cents in San Francisco, with Los Angeles and its highly extended and expensive system charging one-half the rate of its neighbor city, San Francisco. With both using Great Lakes water, why the Chicago rate should be one-half that of Cleveland was likewise difficult to comprehend. Other examples such as the St. Louis rate being half the Pittsburgh rate were cited as indicative of the marked variations in

rate structures of important cities—not to mention what exists in the smaller ones. Although the most dangerous thing to tamper with, rates are in general the principal item in management wherein their exists the greatest need of improvement, standardization and equalization. To attain rate structures of technical and business soundness it is most frequently essential to have absolutely disinterested and experienced engineering services in order to clear the matter of local controversy and family squabbles, which make headlines for the press and do nobody any good.

Another matter reflecting quality of municipal management is the number carried on Water Department payrolls per 100,000 population. Interesting are the survey figures for 17 cities which show the remarkable variation between 58 (low) and 192 (high) employees per 100,000 population. Of significance is the fact that those cities with the lowest per capita employee index prove to be those known for their excellence of water utility operations.

As to distribution systems (ordinarily representing better than 50% of the total cost of the water works properties) too little attention has been given the new and improved means of studying hydraulic flow and pressure conditions, which will permit improvement in layout and economy in design of distribution systems. What counts most is what may be expected to happen in the system during periods of critical demand. Only on this knowledge can improved design and highest economy of materials result. For making such a system analysis the Hardy Cross method continues to be the most satisfactory, but few managers have yet put it to effective use. Mr. McDonnell stated that personal experience with its use has resulted in savings of many thousands of dollars in revamping and extending systems.

Accounting systems and billing methods have been noticeably improved in a number of municipal plants but these are greatly in the minority. Municipal plants should gain by following the requirements of utility commissions such as apply to private utility operations. In fact there should be no distinction in respect to accounting practices — private or public operations. Further, the best managed of the municipal plants pay into the city treasury in the form of taxes, and free services, an amount in excess of the tax which would be collected from the same operation if privately owned. In nowise, however, should the water utility be expected to serve other city departments with water at a rate less than actual production cost.

Programmers

H. S. Nollen, Chairman of the Board
Des Moines Water Dept.
A. M. Brenneke, City Engineer
Dennison, Texas
L. E. Harper, V. P., Omega Mach. Co.
Kansas City, Mo.
(Put on a one-man act that got a laugh but sold a "bill of goods")

And, finally, the most successfully managed water utilities have paid considerable attention to public opinion and popularizing water service. Not the least effective in this important factor has been the attention paid to beautification of structures and properties. Notable examples in this direction included the Departments of Springfield, Ill., Little Rock, Ark., Los Angeles, St. Louis and Honolulu.

"The Part Played by the Public Service Commission in Water Plant Management," by ROBERT A. NIXON, Public Service Commissioner of Wisconsin, Madison, Wisc.

Mr. Nixon described the work of the Wisconsin Public Service Commission as it relates to waterworks, covering: (1) Management Organization; (2) Financing; (3) Accounting; (4) Legal; (5) Service; (6) Rates; (7) Complaints. In Wisconsin the Commission has jurisdiction over all plants including 323 municipal systems and 17 privately managed water utilities. The commission has aided in (1) Management organization by bringing order out of the chaos of management by Boards, Committees, Councils, etc. The Board of Public Works type of management has been urged repeatedly, stressing a non-political and independent board of business men with staggered terms of office and long tenure. The Commission usually does only the preliminary professional service necessary to get more efficient management started. The Commission has no jurisdiction over bond issues but in the majority of cases the cities have asked the Commission to look into the project, its feasibility, method of financing and the proper charges, etc., to guarantee adequate earnings. Only one Wisconsin city is in default on revenue type of bonds.

As a guide to proper financing the Wisconsin Public Service Commission recommends that all municipal plants make charges for fire protection and for governmental use of water. Further, it has insisted upon city funds being kept separate from utility funds, although permitting recorded transfers therefrom with credit shown the utility.

Under Accounting (3) a uniform system has been established and many cities request annual audits by the Commission staff. The staff has also prepared original cost valuations in aiding water departments to set up proper accounts. The rate and research activities of the Commission have proven valuable. In this direction recently Bulletin No. 43 has been released, which incorporates a study of the water rate structures in the larger American cities.

Legal advice, especially by the smaller localities, is often sought. Since the Commission's attorneys have had state-wide experience they can give advice as to contracts, ordinances, organization, etc. Requests are largely from city attorneys in the smaller localities.

The Commission and the State Board of Health have concurrent jurisdiction over service and efficiency and minimum standards of service, quality, etc., have been set. The Health Department has set the quality standards and the Commission largely concerns itself with adequacy of service and rates. The Commission also has jurisdiction over extensions and improvements and its field engineers are continually checking service. Instances of the value of such service is revealed by a 44% reduction in pumpage due to metering of one system, followed up by a continual effort to reduce the amount of "unaccounted for" water.

Utility managers often adopt rate schedules devised for easy administration, but in Wisconsin the rates are more uniform and more effectively standardized than in most states. Under the item "Complaints," the Commission has intervened in many long-standing complaints and has settled controversial issues, such as suburban rates that threatened long drawn out court proceedings. Where criticism has been necessary such has been friendly and helpful in intent.

In answer to a question for G. B. Whitaker (Knoxville, Tenn.), Mr. Nixon stated that the inclusion of a "return on investment" in rates for municipal water utilities is optional in Wisconsin, but ample allowances for depreciation, etc., must be made as the minimum requirement.

"The Water Board as a Factor in Good Management," by HENRY S. NOLLEN, Chairman of the Board of Water Works Trustees, Des Moines, Iowa.

[In private life Mr. Nollen is Chairman of the Board of the Equitable Life Insurance Co. of Iowa. Has served for 18 years on the Water Board.]

Mr. Nollen described the formation and functioning of the Des Moines Board of Water Trustees. When municipal interests were active in purchasing the water company's property more than 20 years ago, it was agreed that a non-political water board management was essential. With this valuable foresight, provision for such management was incorporated in the legislative act permitting the purchase of the property. Board members have staggered terms of 2, 4 and 6 years and are appointed by the Mayor, with the approval of the council, but no person can be appointed who has had any immediate public office. Two members served 11 and 18 years until removed by death. The present Chairman has served the full 20 years but for an interval of 2 years.

The Water Board retained all the company personnel, as experience and integrity were considered invaluable assets. The Board has full power but the manager is the executive officer and is responsible for the actual management and operation. All funds are kept separate from city funds and the Board purchases all materials on the recommendation of the Manager, Mr. Dale Maffitt. Materials and equipment are purchased on price, quality and adaptability to local use. The Board has 1500 acres of land used as park property to protect the quality of the underground flow of the Racoon River which is the source of supply. The Board recognizes the value of longevity of service and several men have had from 20 to 57 years of service in the Des Moines Water Works.

The Board considers the costs and the return on investment before putting in main extensions or services, but also weighs the public health benefits involved due to elimination of shallow wells. The Board cannot compel connection to its mains. Those served outside the city are charged the maximum rate for the type of service rendered plus 50% as a reasonable surcharge.

The Board has never changed the rate structure but has eliminated the old water company $2.00 annual service charge. A charge of $1.00 per quarter per meter is still in effect. It

Earl E. Norman, Gen'l. Sup't. Water Dep't., Kalamazoo, Mich.
Scotland G. Highland, Gen'l. Mg'r. Water Dep't., Clarksburg, W. Va.
Wm. D. Moore, President Am. Cast Iron Pipe Co., Birmingham.

was seemingly the $2.00 annual service charge that caused the discontent.

As to fire service charges the Board is authorized by law to set a fair charge per mile of main where the pipe is of 6" diameter or larger, the rate is limited however to $350. per year per mile. In the late distress period of municipal finances the City Council, in view of the attractive (untouchable) sinking fund in the Water Department's possession attempted cutting the main-rental rate by 50%. The power of the Water Board to sue resulted in judgment in favor of the Board in this matter. Later it was amicably settled out of Court by remitting a portion of the accrued rental, and harmony was restored. The financial integrity of the structure has been maintained even in the face of difficult sailing at times during the 20 years of Board management in which, out of the gross income of $15,830,000, net income has been $5,330,000. Of this, $4,570,000 has been put back into the structure and the balance ($760,000) is the surplus constituting the sinking fund. The Court case has shown that this fund can remain inviolate.

Mr. Nollen commented on the good foresight of Des Moines business men in having the original legislative act incorporate many requirements pertaining to administration and relations with the City government. City ordinances could hardly have been so effective nor as difficult to circumvent through revisions. The marked public favor enjoyed by the Board of Water Trustees has without doubt been responsible for much of the success in administration and the type of Trustees named to the Board during the 20 years of municipal ownership, without political interference.

In the discussion *W. W. Hurlbutt* of Los Angeles described their Board of Water and Light Commissioners. It is usually a nonpolitical board of trustees, each serving 5 years. There are 2000 employees, all on civil service. However, every new employee must pass muster during the 60 day probationary period of service. The Commissioners set wage and salary schedules and they control their own funds and have charge of $425,000,000 of property, of which $200,000,000 is in the water property. The commission has the sole right to establish rates which must be done every 2 years and the City Council must approve or disapprove the schedule. The City Council cannot change the rate schedule. Funds cannot be diverted and the department pays taxes on all property and improvement outside the city limits of Los Angeles. Outstanding business and professional men comprise the Board and their remuneration cannot exceed $50 per month. All employees are under the retirement and disability plan which was favorably adopted by 96% of the employees before it became compulsory.

George Rohan, Sup't. of Water Works, Waco, Texas, stated that Waco has a 5 man Board, 2 of which are elected in even years, 3 in odd years, and the election is usually noncontested. The first president of the Board served 19 years, the present incumbent for 12 years. Mr. Rohan has been on the job 10 years. The highest type of business men are usually elected to the Board. The Board has a 4½ million dollar property and is supreme in management. The Board's funds can however be diverted. The bond issues are paid from Ad Valoreen taxes, with the Water Board paying interest only. Waco has the lowest water rates in Texas except San Antonio and the Board is definitely "out of politics." The Water Superintendent is given full authority in the actual management, of his tenure of service; and, compensation is subject only to the wishes of the Board.

[To E. L. Filby, of Black and Veatch, Engrs., Kansas City, we are indebted for his assistance in reporting the papers covered up to this point.—ED.]

"An Engineer's Viewpoint After Four Years Initial Experience in Public Life," by FRANK O. WALLENE, Cleveland, Ohio.

Quite in contrast to the previous happy paper and discussors' remarks, was the commentary from Engineer Frank O. Wallene, who had but recently resigned as Cleveland's Director of Public Works in Cleveland, a position he had held for the past four years. Unleashing what he termed something in the nature of *"Pasteurized Thermogodamics"* he did not hesitate to say what at least one engineer thought, who had learned that working for a City Council of 33 Tom, Dick and Harrys (up for elec-

tion every 2 years) wasn't exactly conducive to attaining the highest grade of management of debit ridden public utilities, overburdened with increases in payrolls of between $300,000 and $400,000 following such elections at 2 year intervals.

Needful of $1,000,000 annually to operate three sewage disposal plants, and proposing that this requirement be derived through a sewerage charge added to the water bills, proved his defeat when the 33 council members to avoid losing their jobs in a pending election vetoed the plan completely and now taxpayers pay for the "free sewer service to all," through the general city tax fund. [Another neat plan found in Cleveland is that of declaring a moratorium on the mailing out of water bills during the period just preceding elections. But, intelligent citizens pay little attention to Cleveland's local government.]

Mr. Wallene referred to the inexcusably high bonded debt on the water system of $25,000,000, when considering the $5,500,000 annual income from a relatively high water rate. And, he had something to say about the methods of purchasing, and the costly practice of carrying in store supplies valued at $1,000,000 because of the long delays in getting requisitions into the order stage. Mr. Wallene had much more to say concerning his 4 year fight as an engineer attempting to put Cleveland's utilities on a sound operating and management basis, and was thereby the more appreciative of the Utility Board type of management and the City Manager Plan involving a small elected Council. Deploring the general lack of interest by intelligent citizens in local government, Mr. Wallene said it was true now as ever that "Cities are what men make them."

Corrosion

The final session of the Plant Management Division was devoted to a group of papers dealing with means of combatting corrosion, and deficiencies created by such.

"Protecting the Interior of Water Tanks by the Cathodic Process," by EARL E. NORMAN, Sup't. of Public Utilities, Kalamazoo, Mich.

Mr. Norman, being an electrical engineer and having two tanks to which Cathodic Protection has been applied, was able to give a very lucid explanation of the process which we will not attempt to detail here.

[The process has been explained in various articles appearing in WATER WORKS & SEWERAGE during the past two years, and recommended to interested readers is that which appears on page 81 of the 1940 Reference and Data Section of the April issue.]

In substance the method consists of converting a metal water tank into an electro-plating cell, which prevents the hydrogen normally liberated in corrosion phenomena from leaving the corroding metal surface. Thereby corrosion is "blocked" against further progress. Further than that the metals naturally present in the water (calcium being one of the commonest) will actually be caused to plate out on any exposed metal spots, producing an added grey protective coating. In the process, direct current is caused to flow in small amount, from the anode suspended in the water, through the water to the tank shell which becomes the cathode in the circuit. As the corrosion pits gradually become healed in the plating process the flow of current diminishes to the continuous economic level sought. The initial installation is relatively inexpensive and the results reported thoroughly justify the current consumed, said Mr. Norman. Old in pipe line protection the scheme is relatively new in water tank protection but has given a good account of itself to date. According to Mr. Norman, there are now 600 tanks so protected in the U. S.

Taking a concrete case, Mr. Norman said that in the case of a 350,000 gallon Kalamazoo tank it would have cost $700 to prepare the surface and paint the interior below the water line —not to mention the inconvenience of taking the unit out of service. In contrast the investment for providing Cathodic Protection amounted to only $400. In another case a 750,000 gal. tank was equipped at the same cost, whereas painting would have cost $950. In the latter case, comparing the year to year costs (assuming the paint job to last 5 years) the annual cost becomes $190. This is to be compared with an estimated 15% depreciation charge on the cathodic equipment and a $12.00 annual cost for current, to make a total cost of $72 per year. The clear saving of $118 represents almost 30% return on the $400 investment. The additional advantage to be considered is that Cathodic Protection is prevention rather than cure and that the "patient" is not "hospitalized" for the required periods of renewing the protective coating.

Mr. Norman said that U. S. experience indicated that current costs ran between $3.00 and $25.00 per year, depending upon size of installation, condition of tank, water quality and current rates. The cost of installations from $200 to $525.

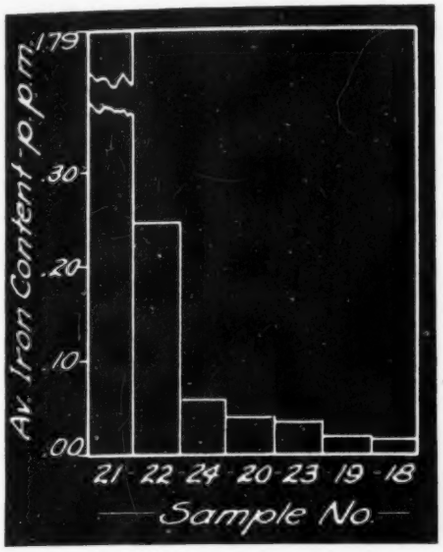
"The Effect of Internal Pipe Lining on Water Quality," by PAUL WEIR, Sup't. of Filtration, Atlanta, Ga.

Mr. Weir, in talking from lantern slides, described the Atlanta method of making a study to determine the "corrodibility index" for 30 different qualities of pipe, many with a variety of protective linings. The experimental set up (see cuts) was designed to represent what happens to various pipe materials in dead ends, 2 ft. sections of each pipe being set up and flow rates in dead ends simulated through these sections. The visible results of corrosion were those

Thirteen Pipes + One Weir

A section of Atlanta's battery of test sections of 30 specimens of pipes of various materials, a number having linings or protective coatings. In the picture is Paul Weir, who is making the comprehensive study of what Atlanta water does to these pipe materials, and vice-versa. It's a demonstration of the "seeing-is-believing" variety, comprehendable from Manager to Meter Reader.

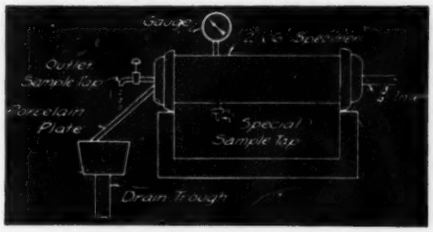
obtained on white porcelain plates, on which the water leaving the sections was allowed to drip. Chemical tests for oxygen loss and iron pick-up were made in parallel with the clear cut picture given by the intensity of iron stains on the white plates. Also, in the case of cement lined pipes, from which no iron was dissolved, the alkalinity (dissolved lime) pick-up was determined, and the rate of its disappearance plotted.



The Record for ¾" Service Pipes
(Average Iron Dissolved After 2 Years of Service.)
No. 21—Black Steel
No. 22—Galvanized Steel
No. 24—Copper Bearing Steel (Galvanized)
No. 20—Cement Lined Steel
No. 23—Galvanized Wrought Iron
No. 19—Yellow Brass
No. 18—Copper Tubing

This valuable and conclusive method of studying pipe materials and linings which is continuing at Atlanta, was thoroughly illustrated by lantern pictures along with results to date (see graphs). Enough had already been conclusively shown to enable the Department heads to purchase the most suitable pipes in the future. The value of the newer asphalt or pitch impregnated cement linings for pipes had been most effectively demonstrated in the tests, wherein "seeing is believing" and theorizing and speculating are unnecessary. Likewise the effectiveness of bituminous enamel linings was evident and the desirability of copper tubing and red-brass pipes for service lines was early apparent.

In Mr. Weir's condensed presentation very little in the nature of detailed data could be given, but in due time we trust that it will all be published. The chief objective in his presentation was to indicate the simplicity of the scheme of revealing to water works managers which piping materials will prove most suitable for any water in question. Little if any laboratory work is required in getting to the basic facts.



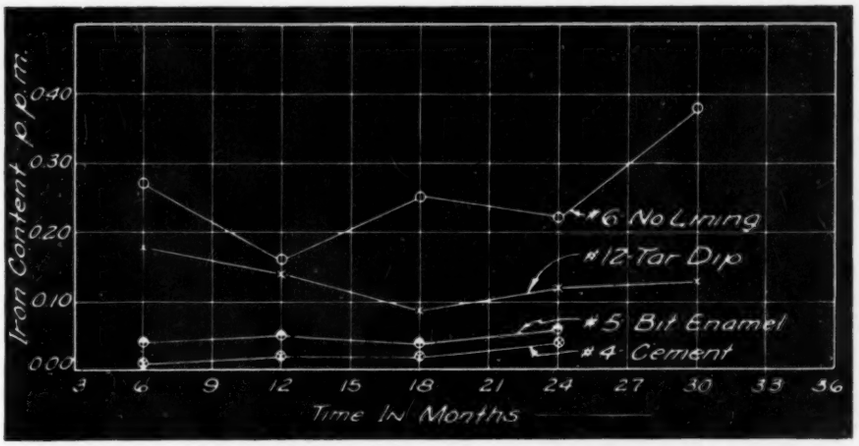
Sketch Showing Details of Set-Up of Test Specimens in the Photograph
(In the battery set-up the pressure gage is on the supply header only. The dripping rate is set to simulate rates of water displacement in dead ends.)

[This all brings to mind that this same drip plate scheme has been effectively used in the office of Town Manager Blankenship at Orange, Va. (also Sup't. of Water Works) as an index of the effectiveness of various treatments in correcting corrosion of pipes in existing mains and service lines. The drip rate is kept constant while the plates are changed with each change in treatment at the plant, such plates being preserved for comparison of iron stain intensities. The idea is a very practical one.—ED.]

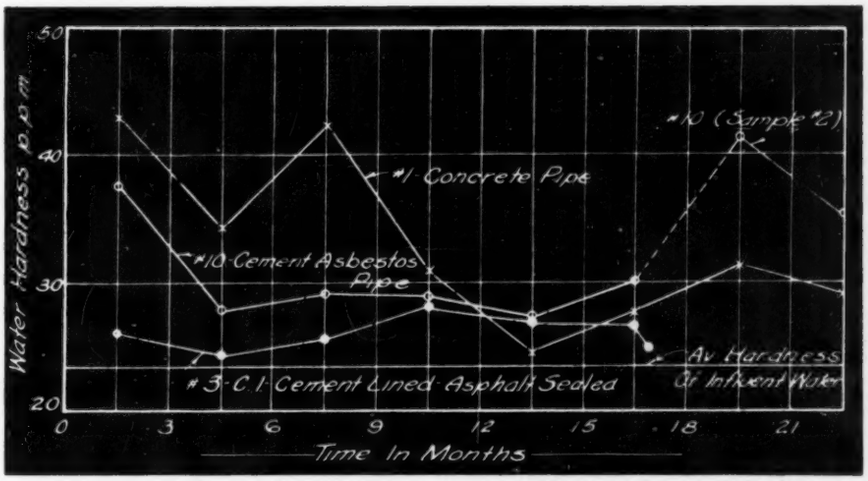
"Lining Cast Iron Mains in Place With Cement Mortar," by JAS. E. GIBSON, Manager and Engineer, Water Department, Charleston, S. C.

Mr. Gibson's paper has already been printed in our May issue. Prepared for publication in WATER WORKS & SEWERAGE its use was postponed in order that Mr. Gibson might first present it before the Association. The most interesting part of the presentation, which the published paper lacked, was the showing of movies of the main cleaning and lining operations in color film.

The lining project, which was done



Graphic Record of the Effect of Three Linings on the "Corrosion Index" as Revealed by the Iron Content of the Drip Water After Various Periods of Continuous Service



Graphical Record of Alkalinity and Hardness Pick-Up of Water Through Pipes Lined with, or Fabricated from, Cement Mortar
(Bitumen sealed cement lining gives the most satisfactory leaching record, the deposits on the drip plates also revealing as much. Note that asbestos cement pipes fell between all cement and asphalt sealed cement.

(1) *Chas. Barry, Badger Meter Co., Guthrie, Okla.;* (2) *H. F. Blomquist, Supt. of Water, Cedar Rapids, Iowa;* (3) *Duke Nathan, Goodrich Rubber Co., Akron, Ohio;* (4) *Wm. S. Stanley, Cons. Engr., Muscatine, Iowa;* (5) *Jim Barker, Neptune Meter Co., San Francisco;* (6) *C. W. Mengel, Director of Public Works, Greensboro, N. C.;* (7) *R. W. Sparling, Sr., Sparling Meters, Los Angeles;* (8) *"Lou" Quigley, Supt. Water and Sewerage, Fort Worth;* (9) *D. D. Gross, Chief Engr., Board of Water Commissioners, Denver.*

by the Tate Pipe Lining Co. of Andover, Mass., resulted in an average increase of 230% in main capacities in Charleston—some of the old pipes having a 60-year service record, with coefficients of 39 to 44 before cleaning, which was raised to 98 and 113 by the in place lining.

As to costs, Mr. Gibson stated such to be ¼ to ½ the cost of replacement with modern factory cement lined pipes, the averages being the following costs per foot, the maximum being about 50% more than the averages given:

Main Size	Streets Paved	Unpaved
4"	55c	—
6"	90c	46c
8"	$1.55	50c

So satisfactory were the results that the program is to be continued.

(NOTE: In the Symposium on Steel Pipe, which follows immediately, two papers deal with bituminous coatings for protection of mains. One by Deming Bronson of Hill, Hubell & Co., and the other by Harry Hayes, Jr., of the Los Angeles Water Department.)

Steel Pipe*

In connection with the work of A.W.W.A.'s Committee on Steel Pipe, a symposium of five papers occupied one session presided over by W. W. Hurlbut, Chairman of the Committee.

"Construction and Tests of High Pressure Steel Water Supply Line for Colorado Springs," by E. L. MOSLEY, City Manager, Colorado Springs, Colorado.

In an interesting paper Mr. Mosley described the high pressure steel supply main built during 1939 to supplement the original main through which water is delivered to Colorado Springs. In designing this pipe line the wall thickness was calculated and 1/16" added for corrosion. However, it was pointed out that this was not needed because the pipe is laid in disentegrated granite which is noncorrosive. Of the work done last summer 54% was in tunnels and steel pipe was used throughout. Pipe fabricated from cold rolled plates using union melt welding was used in this job.

The 30" guage railroad was used for a period of six months. This railroad was built to lay the original pipe line and has since been used as a sightseeing railway.

Dresser couplings were used throughout this line. There are 14 vertical angles on the line and a substantial portion is laid on very steep grades. The project was commenced December 28, 1938, and was completed, tested and placed in operation on August 1, 1939.

"Behavior of Flexible Steel Pipe Under Trench and Filled Loads," by RUSSELL E. BARNARD, Advisory Engineer, Spiral Welded Pipe Department, The American Rolling Mill Co., Middletown, Ohio.

In a highly interesting paper, which is considered a distinct contribution in the field of design of flexible steel pipe, Mr. Barnard discussed factors which are involved when determining wall thickness of steel pipe to adequately carry earth loads of given size. He stated that experience has shown that flexible steel pipe under earth loading cannot be designed properly when the flexure formula is used to determine pipe wall stress. Methods of stress analysis which apply to rigid wall pipe do not apply to flexible pipe.

Mr. Barnard pointed out that flexible structures, as a class, are well represented by corrugated culverts under railroads and highways where they have been in general use since 1908. Although wall thicknesses have largely been from 1/16" to 5/16" with an average of less than 1/8" crushing of pipe under highways and railroads is virtually unknown.

Two examples were given to show the tremendous resistance of thin metal cylinders to collapse from earth pressure. The first is a 72-inch diameter 8-gage (0.172") section under a railroad track carrying wheel loads of 90 tons. There has been no change in this structure in the past nine years although there is a load passing over it several times daily. The second example referred to is a 60-inch diameter 8-gage (0.172") section under a 77-foot railroad fill. No appreciable change in shape of this pipe has taken place in eleven years.

No stress determinations using the ordinary flexure formula would account for anything except quick and complete failure of these structures. But failures did not occur. Obviously then the theory of strength calculations using the flexure formula which worked so well with rigid wall pipe, but consistently indicated failure for flexible pipe when no failure occurred, was being erroneously applied in the case of flexible pipe. This, then, indicates that flexible pipe acts in obedience to other factors not credited in the flexure formula.

Various tests begun as early as 1908 were referred to and, it was pointed out, all of these showed that the load sustained on the rigid pipe (concrete, cast iron, vitrified clay) tends to concentrate at top and bottom. Flexible pipe, on the other hand, deflects slightly and distributes the load uniformly around its circumference. The unit pressure at the top and bottom are in some cases as little as one-third that on a rigid pipe under identical loading conditions. Since flexible pipe may change shape without failure, it possesses the ability to transfer the vertical load into a horizontal thrust and thus support the vertical load in a manner somewhat similar to the action of an arch. Thus, although the maximum load-carrying capacity of flexible pipe depends to some extent on the wall thickness, the pipe is usually able to make full use of the load-carrying ability of the earth surrounding it. If the wall itself

*For the reporting of the above papers presented in the Steel Pipe Symposium we are indebted to A. Clinton Decker, Sanitary Engineer, Tennessee Coal, Iron & Ry. Co., Birmingham, Ala.

were rigid the movement described above could not occur without wall fracture; and it is therein that the inherent difference between rigid and flexible behavior lies.

It was pointed out that the engineer accustomed to think of flexure formula and rigid construction, is apt to contend that permanent deflection can only occur after the yield point has been passed and that, therefore, a pipe in this condition has failed and is dangerous. In the process of fabrication, steel pipe is frequently stressed beyond the yield point. Regardless of this, however, steel pipe and pressure vessels are used in all manner of high pressure work without hesitation.

Frictional force was discussed and it was pointed out that in the case of rigid pipe the frictional force is additive while in the case of flexible pipe it is subtractive. Data on performance of steel pipe under fills and embankments, using various thicknesses of pipe, were given.

"Utilization of Steel Pipe for Water Supply and Distribution Systems," by H. R. REDINGTON, National Tube Company, Pittsburgh, Pa.

Mr. Redington reviewed the developments which have led to the adoption by the Committee on Steel Pipe Specifications of its report submitted to the Committee on Water Works Practices at this Convention. He referred to the enormous amount of work done by the Committee and their fine cooperation in working with the pipe manufacturers in assembling data to make the specifications the best possible.

The studies made by those working on this subject necessitated the collection, classification and detailed study of data. Special attention was necessary by the pipe manufacturers on the grades of steel best suited for pipe, the size, wall thicknesses, etc. They also studied carefully the grade of ore, limestone, coal, coke and pig iron, entering into the manufacture of steel.

It was pointed out that experimental materials of "yesterday" become the standards of today, and we should not remain static in our attitude toward materials for water pipe.

Mr. Redington congratulated the committee and pointed out that the specifications prepared by Committee 7-A, based on their painstaking studies and analyses of all available data had resulted in submission at this Convention of six specifications as follows:

Programmers.
R. E. Lawrence, Black and Veatch Engrs. Kansas City, Mo.
Frank O. Wallene, Former Director Dept. of Utilities, Cleveland, Ohio.
Claud R. Erickson, Mech. Engr. Water & Light Dep't., Lansing, Mich.

Riveted steel water pipe and lock bar steel water pipe.

Electric fusion welded steel pipe 30 inches and over.

Electric fusion welded steel pipe 4½ inches to, but not including 30 inches.

Coal tar enamel for protective coatings for 30 inches and larger steel pipe.

Coal tar enamel protective coatings for 4½-inch to, but not including 30-inch steel pipe.

Cement mortar protective coating for 30-inch and larger steel pipe.

These specifications now establish definite standards for the guidance of the water works profession and the manufacturers. (Specifications were approved by the A.W.W.A. Board at the close of the Kansas City Convention.—ED.)

"Types of Protective Coatings Used for Protection of Steel Water Lines," by DEMING BRONSON, Vice Pres., Hill Hubbell & Co. Division, General Paint Corp., Cleveland, Ohio.

The first part of Mr. Bronson's paper dealt with interior protection of steel pipes. The best known protection is galvanizing, which is zinc applied by dipping clean pipe in molten zinc. The second method of interior protection is cement lining (centrifugally), which method is now available from at least two manufacturers of steel pipe. A third method consists of two coats of cold applied coal tar coating,—a combination of spraying and brushing, 1/64″ in thickness. A fourth method is by dipping in a hot asphalt bath after cleaning of scale, grease, etc., from the steel. This method gave protection of from 1/100″ to 3/100″ thickness in coating. The most generally accepted method is the hot centrifugally applied coal tar enamel. A cold application of liquid coal tar primer is used on the thoroughly cleaned steel surface, followed by the hot tar enamel, the pipe being revolved until the enamel has cooled to a non-running hardness. The thickness is 3/32″ with a plus or minus tolerance of 1/32″.

For exterior protection the methods most generally accepted are red lead and bituminous coatings applied cold; galvanizing; bituminous coatings with or without wrappings of rag felt or asbestos felt; coal tar enamel with coal tar impregnated asbestos felt wrapping. White wash or craft paper are used to protect the coating in transit and to reflect heat when exposed to the sun.

Other industries have proven, after many years, that protection for steel pipe: (1) Must have substantial thicknesses; (2) Coal tar to be the most generally accepted protective coating material; (3) Wrappers give greatly increased protection; (4) Protective coatings can be effective only if properly applied.

It was pointed out that linings cannot always be justified. Certain waters have no deleterious effect on bare steel pipe. The quality of waters must, therefore, be considered as to tuberculation, incrustation or corrosion and should be the basis for lining use. However, lining assures the continuous volume of flow over a period of years.

Attention was directed to the fact that it is uneconomical to use steel itself by increasing wall thickness to take care of possible corrosion, but rather that protection should be used for the steel, and, thus, secure the dual advantage of lighter weight walls and assured smoothness of bore in the future.

In closing, Mr. Bronson stated that the specifications adopted by Committee 7-A cover a sound and adequate protection for steel pipe.

"Service Life of Coal Tar Enamel Protective Coatings," by HARRY HAYES, JR., Civil Engineer, Field Engineer Investigations, Dept. of Water & Power, Los Angeles, Calif.

Aided by lantern slides, showing to excellent advantage the structures described, Mr. Hayes reviewed the use of protective coatings for water mains, tanks and other steel structures in Los Angeles. He reviewed the development of coal tar enamel with a filler as manufactured today, and stated that the length of life of these enamels is believed to be practically indeterminate.

The Protective Coating Laboratory of the Los Angeles Department of Water and Power has cooperated with the coating manufacturing industry to improve the product and

correct deficiencies of formerly supplied materials. The City of Los Angeles now has in service more than 1,000 miles of steel pipe, of which 200 miles is 24-inch and larger. Of this, 50 miles is protected with the new type of enamel, and 25 miles protected with this material is now being laid.

The old original type of coal tar enamel was used in 1913 at Long Beach, Calif., on a tank. Above the water line this enamel sagged. However, no change has occurred below the water line. Since this installation enamels have been developed having a filler which gives mechanical strength and other improved properties. The new enamel, however, has high ductility. It will stand both high and low temperatures and also is highly resistive to abrasions, etc.

The outlets through the San Gabriel Dam are each 1,000 feet long. There are two 123″, one 96″ and one 52″ in diameter. The 52″ is enameled, the 96″ is unlined and the 123″ is lined. Plasticized pitch type enamel was used. During the recent flood the actual measured coefficient of friction according to the Fanning formula was as low as .0065. The velocity which had been estimated was 40 feet per second. The velocities actually obtained during this flood were:

Forty-six feet per second through 52″, 67 feet per second through the 96″ and 72 feet per second through the 123″ lined outlet.

Although the anticipated adhesive qualities of the enamel did not contemplate velocities in excess of 40 feet per second, an inspection after the flood showed all lines in practically perfect condition.

Water Purification Developments

"Active Problems in Water Purification," by PAUL HANSEN, Greeley and Hansen, Engineers, Chicago.

Mr. Hansen's paper constituted a very thorough review of the newer considerations and developments in water treatment. We can not attempt to cover it adequately for the paper in its self is an exhaustive digest and commentary on developments, in which the recent trend to superchlorination, defined as "break-point chlorination," seemed to be the present highlight in attaining taste and odor destruction. Withall, there was a high degree of sterilization security, which might prove justified based on recent suspicion directed toward water quality as responsible for intestinal disturbances. On the other hand Streeter (U.S.P.H.S.) considers present Treasury Department Standards of Water Quality adequate, provided the source of supply is given proper consideration as to its pollution index.

George S. Moore, Supt.
Water, Light and Sewerage
Albermarle, N. C.
(Chairman of the N. C. Section)
Sam F. Newkirk, Jr., Supt.
Elizabeth, N. J. Water Department
(May be "Singing Sam"—but he ain't the Barbasol Man)
Geo. S. Rawlins, Consulting Engr.
Charlotte, N. C.

In preparing water for filtration Mr. Hansen mentioned the new yardstick applied at the Richmond, Va., plant, which reveals the "filtrability factor" as the ultimate measure of effect, rather than visible floc quality. The factor involves speed of filtration plus clarity of filtrate through a standardized laboratory filter. The results are thoroughly translatable into plant performance and result in maximum economy in chemical use.

He listed as having potentialities the matter of lime recovery from softening sludge, through vacuum filtration and calcining in a multiple-hearth furnace, such as had been developed in conjunction with the Southern California Water District softening plant. Under-water burners for recarbonation also constituted a new development of interest.

As to ammoniation, which has seemingly come to stay, it was of interest that aqua ammonia could be employed more economically than the anhydrous ammonia or sulphate of ammonia. He cited the Washington experiences with aqua ammonia, the knowledge of which had led to its adoption for the new 80 m.g.d. plant of Toledo, Ohio, as the most economical scheme. (An article describing the Washington installation is scheduled to run in our August issue. In the discussion which followed Mr. Lauter pointed out that the switch to aqua ammonia was to save Washington $3,000 per year as is revealed in his article.—ED.)

Concerning filter bottoms, Mr. Hansen stated that many plants had gone to the Wheeler type bottom and that confidence was growing in the porous plate bottom introduced by the Carborundum Co., which had now gone through a test period of establishing its dependability in several plants—notably at the Grand Rapids, Mich., softening plant where trouble if any, might be expected in the nature of cloggage of the plates. The largest American installation is that of the Ford Motor Co. at Flat Rock, Mich., but larger ones have been made abroad, notably at Singapore.

In maintaining clean filter beds the surface wash idea had about completely superseded the high velocity wash scheme, and surface jetting was being rapidly adopted as standard practice. This new plant at Milwaukee was so equipped and surface wash is now being installed in the new Toledo plant. In this scheme, John R. Baylis of Chicago deserved credit as he also did in other directions, such as his work to determine the most effective material and grain sizes for filters—namely sand of 0.6 m.m. effective size for maximum washability and freedom from bed troubles.

While chemists continued to treat water for corrosion control, it was still felt that effective linings for water pipes were justified on the score of sustained carrying capacity above that attained through chemical treatment. The efficacy of chemical treatment for maintaining high coefficients following main cleanings had been studied by Wiggin and Norcom with conclusions justifying ultimate dependence on linings in preference to chemical treatment to prevent regrowth of tubercules.

"Design Features of the Water Conditioning Plant at Lansing, Mich.," by CLAUD R. ERICKSON, Mechanical Engr., Board of Water and Electric Commissioners, Lansing, Mich.

Mr. Erickson briefly described Lansing's new Water Softening Plant, in service now for almost 6 months, and cited some of the novel features of design. Amongst these are the aerators involving the use of Transite pipe for the rather corrosive Lansing deep well water. The softening involves flash mix, then flocculation for 1 hour in a Dorr Flocculator, followed by 2-hour settling in a two-story basin, recarbonation, another 2-hour settling and final recarbonation of the filter effluent. The settling basins are of two-story construction, providing economy of structure and land use. All wash water is reclaimed by sedimentation and the thickened sludge is pumped to sludge lagoons almost 1½ miles distant. The filters are equipped with sand expansion indicators and the filtration rate is set at 3 g.p.m./sq.ft. To check pipe gallery sweating a dehydrator has been installed.

"Specifications for Chemical Dry Feeders — the Need for Improvement," by L. E. HARPER, Vice Pres., Omega Machine Co., Kansas City, Mo.

"What's wrong with feeders for dry chemicals; What's wrong with 'specs' for dry feeders?"—these were the two questions which the younger of the Omega Harpers set out to analyze, and to demonstrate. In his dramatized one-man act, Mr. Harper accomplished both ends effectively, with the aid of interspersed comedy which many a filter-plant operator recognized as representing more truth than poetry. And surely the designing engineer recognized some of the shortcomings of present day dry feeders.

Mr. Harper's thesis was that "We are just now emerging from the dark-ages of chemical feeding." In this direction he promised that he could fully meet "specs" for dry feeders, as commonly employed by engineers, with a pocket model which he produced from his coat pocket. He solemnly read the "specs" and then to the considerable amusement (and amazement) of his audience, he made that little watch-fob edition of an Omega do the job of feeding at the rate of better than one ton of dry chemical per day, as required in the "specs." This palm-sized feeder with a one-ton capacity but a 4-ounce hopper, he added, would actually be all that is required for 90% of the purification plants in the U. S., at least in respect to meeting the letter of the catalog type of specification generally employed by engineers.

In going back 12 years, Mr. Harper stated that the gravemetric type of feeder then made its appearance in the field, but had only very recently come into full recognition. The true worth of this weight type feeder (in comparison with the archaic volumetric type) was then effectively pictured in a humorous skit showing an operator at the task of checking the setting of a feeder with an ordinary pocket-watch, a pair of rusty laboratory scales, and an old issue of WATER WORKS AND SEWERAGE to catch the chemical fed in one minute (i.e., more or less); than a little chemical got spilled, and that was estimated. (Truth is sometimes stranger than fiction, brother Harper.—ED.) He then pictured the operator at the task of re-calibrating the volumetric type feeder with each change from one chemical to another.

In presenting the case of the automatic gravametric weigh-control feeder its several advantages included; first, accuracy as of chief importance; next, an exact record of pounds of chemical used from storage; third, the end of the re-calibration and feed check nuisance.

In referring to lime feeders, specifications for slaker tank performance needed improving. For instance an important consideration is temperature control for efficient slaking, productive of economy. It had been shown that the optimum slaking temperature should be held between 175 and 180F. Thus automatic heaters and volume control of slaker feed water were considered as meriting more attention.

Returning to specification deficiencies, Mr. Harper cited the importance of so-called auxiliary equipment such as dust eliminators, bin shut-off gates above the feeder proper, adequate hopper capacity (not less than a full 8-hr. supply of chemical) effective dissolving or emulsifying chamber (not less than a 3-minute retention at maximum feed rates), motor of dependable type for operation under dusty or moist conditions.

In respect to the important chemical wetting and solution chamber, Mr. Harper pointed out that complete solution of coagulants and considerable dilution was conducive to efficiency and a preventative of wasted chemical. In regard to minimum and maximum rates of chemical feed, a ratio of 1 to 40 was actually all that is needed, whereas 1 to 100 in specifications added to the difficulty of securing more important attainments in design and performance.

"Calcium Hypochlorite in Water Purification," by JOHN O. LOGAN and WALTER L. SAVELL, Technical Service Dept., Mathieson Aklali Works, New York City.

This paper was presented in abstract by Mr. Logan from the Chicago offices of Mathieson Alkali Works, Inc. It revealed the history of water chlorination which began with chlorine gas, replaced by chlorinated lime (hypochlorite), then the use of liquid chlorine and now the re-entry of a different form of superior hypochlorite—the so-called high-test hypochlorite of double chlorine strength as compared to the now-outmoded chlorinated lime and completely stable, free flowing and soluble. Its concentrated form, stability, solubility and ease of handling all combine to make the newer calcium hypochlorites ideal for many and varied uses in water plants. Amongst the uses were listed emergency chlorination, disinfection of distribution systems, new wells, filters, reservoirs and clear-wells.

Then Mr. Logan gave a rather detailed reply to the question "What is this modern hypochlorite?" In brief, it is a dry, free flowing white powder containing between 70 and 75% available chlorine. Pound for pound there is considerably more chlorine in a drum of hypochlorite weighing 100 lbs. than in a cylinder of liquid chlorine of the same gross weight. The answer?—the heavy steel cylinder requiring handling and return to the chlorine producer. The hypochlorite drum is non-returnable.

The material (hypochlorite) has recently been further improved and rendered practically dustless by a process of granulation. It is likewise less able to take up atmospheric moisture and the new product will lose less than 10% of its chlorine strength after a year's storage in a hot room—much less in cool storage. Such properties render it attractive as a practical storage reserve of chlorine for unexpected or emergency uses for which it has become well known, also for temporary supplemental use.

Mr. Logan's paper closed the Technical Program of the 60th Convention of A.W.W.A.

REPUTE OF SLUDGE INCREASING

To us it was of interest to note in the widely distributed publication "Lawn Care" put out by O. M. Scott and Sons, seed producers of Marysville, Ohio, that *Sewage Sludge* was included in a list of materials suggested for lawns and golf courses as worthy sources of humus and growth promoting values. Sewage sludge was listed along with stable manure, peat, mushroom soil, etc. Here is what "Lawn Care" had to say about sewage sludge.

"*Sewage Sludge* is the residue of city sewage disposal plants and is usually available for little more than the cost of hauling. Some object to using it because of the odor that comes from it in damp weather. It should be used where it can be immediately mixed into the soil. Ordinary sewage sludge is not to be confused with the activated type which is processed and sold as a commercial fertilizer."

If this sort of publicity continues operators should find the local sewage works an increasingly popular place, and profits from sludge sales on the up. But the first requirement for repeat orders is a product put in condition that will not turn the public against it. By this we mean a dry and fairly uniform pulverant or granular product.

PENNA. W.W. OPERATORS HOLD ANOTHER "BEST MEETING"

Reported by HARRY A. FABER*

Associate Editor

THE meetings of the Penna. Water Works Operators Association, held each spring on the campus of Pennsylvania's State College, have come to be considered meetings *not* to be missed. This is the conclusion of all who have ever been present, and especially of the 283 members and guests who were registered at last month's meeting on June 24th to 26th—which represented the 13th held.

In addition to the judicious variety of technical papers, an energetic program committee always manages to provide features of new and unusual interest and a live wire Committee on Entertainment sees to it that this end of the affair is adequately taken care of through sports contests.

Presidents

(Retiring) Chas. J. Bruce, Sup't. Evitts Creek Water Co. Cumberland, Md. (Collects Water in Penna.; Distributes it in Md.)

(Incoming) Larry S. Morgan, Engr., State Dep't. of Health Greensburg, Pa. (Awarded President's Cup for Most Valuable Paper.)

This year a pipe cleaning demonstration, on a section of the State College distribution system, was provided by the National Water Main Cleaning Co. in cooperation with the Water Department of the Boro of State College. Members could see at first hand the construction and operating details of equipment used for this purpose, as well as having a better understanding of the technical paper on main cleaning presented in the program.

Sun-rise on State College Campus.

"Information Please"—Pleases

A novel part of the technical sessions was *"Information Please"*, in which four selected experts were guaranteed to answer questions on water works operation—or the Association paid one dollar in cash for each unanswered or unsatisfactorily answered question. The "experts" pressed into service (sans fee) were: George Taylor, Scranton; L. S. Morgan, Greensburg; George Norcom and H. A. Faber, New York. More than twenty questions, some factual and some downright tricky, were asked. The "experts" were confounded to the extent of costing the Association four crisp dollar bills, handed out by Secretary Glace. Then came the unlooked for turning of the table when, upon proposal, the four prize winners were put up as a new set of "experts." Then the quiz was continued with E. C. Goehring, Beaver Falls; F. E. Daniels, Harrisburg; R. B. Adams, Wilkinsburg, and R. G. Eppley, Harrisburg, "on the spot." (P. S. These "experts" out-experted their predecessors, costing the Association exactly no dollars!)

"Casey" (E. M.) Jones, Mgr. of Sales, Simplex Valve & Meter Co., Philadelphia. (Entertainment Committee Chairman)
Harry M. Freeburn, Dist'r. Eng'r., State Dept. of Health, Philadelphia (Past-President and Donor of the Coveted Cup.)
Jas. G. Griffiths, Mgr., New Kensington (Pa.) Water Co. (Elected 2nd Vice-President.)

Operator Licensing Still a Debated Topic

During a business session, municipal and private water plant officials were given opportunity to air their reactions toward an operators' licensing act repeatedly proposed by the Association's Committee on Licensing, but never yet made satisfactory to the many private water company interests in Pennsylvania. It was decided that cooperating committees of the Water Works Association, representing privately owned utilities; of the Boro Managers' Association, representing the municipal administration interests; and of the committee of the Penna. Water Works Operators Association, solely comprised of privately owned water utility executives, should come to an agreement on a satisfactory licensing bill before it is finally submitted to the State Legislature for consideration. To date there has been decided

Buddies

1st Vice-Pres., Harry J. Krum, Sup't. Filtration and Sewage Treatment Allentown, Pa.

Sec'y.-Treas., "Mike" (I. M.) Glace, Consulting Engr., Harrisburg, Pa.

(Work in harness together everywhere but on the golf course.)

*Research Chemist, The Chlorine Institute, Inc.

and strong objections from the private water companies, who feel that such an act will create undue interference and is not required to insure safe water or security of positions of competent employees in water company organizations.

On the Program
G. Webber Knight, Manager, Natrona (Pa.) Water Co.
J. A. Frank, Engineer, Nat'l Water Main Cleaning Co.
E. H. Ingle, President, Electro Rust-Proofing Co., Dayton, O.

Technical Sessions

"Demonstration of Method for Determining Threshold Odor Numbers, with Motion Pictures," by W. A. WELCH, West Virginia Pulp and Paper Co. ("Nuchar" Division) Philadelphia, Pa.

Using laboratory equipment, Mr. Welch demonstrated the least complicated procedure suitable for threshold odor measurements in small water treatment plants. In a graphic presentation colored solutions and the demonstrated adsorption of color by activated carbon were used to simulate odor and odor adsorption from water.

Following this, a nearly full length motion picture—entirely in color—was exhibited. The film is designed to explain water purification to the layman and several copies will shortly be made available to water works operators for showing to civic groups. The attractive film has been planned and edited with the thought that its showing should result in greater appreciation of the function and service of local water treatment plants and a greater recognition of the work of their operating staffs. [It was announced by Mr. Welch that "Nuchar" advertisements would be employed to inform technical men when these 16 m.m. size color films are finally ready for distribution for public exhibition at no charge for their use.]

Prize Paper

"Operation Reports," by L. S. MORGAN, District Engineer, State Health Dept., Greensburg, Pa.

Water plants in Pennsylvania are required to submit to the State Department of Health each week a detailed report which includes operating and analytical data. Mr. Morgan selected five of these reports and discussed them as examples of what details they do and do not explain. Three reports were from filtration plants and two were from plants involving only pumping and chlorination. They were photographed on lantern slides and projected so that the audience could follow all comments.

These reports, according to Mr. Morgan, should provide the best guide to improving plant operation because they supply a summary of information on past results. Reports which enable a correct interpretation serve a useful purpose, both for the plant operator and for the State Health Dept. Engineer, but those reports which are incorrect or are likely to be misinterpreted are worse than useless. The author discussed the selected reports in detail, describing what conditions appeared to obtain at the particular plants and what conclusions could be drawn as to the efficiency (or deficiencies) of

Owen Rice, Research and Devel. Engr., Hall Laboratories, Pittsburgh.
Joseph E. Lyles, Chemist in Charge, Filtration Plant, Tampa, Fla.
(Inventor of the Lyles Process of Producing Ferric Coagulant from Iron Scrap.)
R. B. Adams, Chief Chemist Penna. Water Co., Wilkinsburg, Pa.

treatment. The presentation was an effective means of showing operators that such reports had more value than a mere record of the State Health Department.

In discussion, *I. M. Glace,* a former Health Dept. district engineer, cited the importance of such reports as a defensive record for the plant operator and said they were carefully scanned by the Health Dept. He also noted that, unless they received prompt questioning by the Department, the operator must infer the report is correct and that operation is satisfactory.

George Norcom, New York, pointed out that most states require monthly operating reports and asked the advantages of weekly reports in Pennsylvania.

John J. Shank, Waynesboro, offered the explanation that small water treatment plants predominate in Pennsylvania, and for the most part have very limited technical supervision. For these plants, a weekly report facilitates greater promptness in checking operation.

C. E. Palmer, Chief Operator, Erie Filter Plant.
(Inventor of the Palmer Filter Sweep.)
E. C. Goehring, Chemical Engr., Beaver Falls (Pa.) Water Co.
(User and booster of the Filter Sweep.)
Fred. Stuart, President, Activated Alum Co., Baltimore
(National Distributor for Palmer's Filter Bed Agitators.)

[Mr. Morgan's paper was noteworthy for the many helpful suggestions and guides to operators and the author, for it, was awarded the President's Cup. This cup which should be named for its donor, Past-president H. M. Freeburn, is given each year to the author who is judged to have presented the most valuable paper at the conference.]

"Chemical Analyses and Their Interpretation," by JOHN J. SHANK, Director, Wayne Laboratories, Waynesboro, Pa.

For the benefit of plant operators who do not readily understand the application of analytical results to operating problems, Mr. Shank discussed the reasons for making sanitary and mineral analyses of water. He pointed out what such analyses disclosed and how they could be used to best advantage. For the convenience of those not familiar with a variety of waters, a guide was offered in the nature of a table listing the "normal" amounts of various constituents in "Good," "Fair," and "Suspicious" waters typical of Eastern Pennsylvania.

Developments of Benefit to Small Plants

"The Value to the Small Company of Recent Developments in Water Works Practice," by COL. W. A. HARDENBERGH, Public Works Magazine, New York, N. Y.

The author enlarged on the general topic of how valuable a knowledge of both standard and new practices in water treatment could be to plant operators. His discussion covered a

wide range of topics under the headings of water quality, plant administration, and public relations. In this brief review it is possible only to note that application of the suggestions made by Mr. Hardenbergh would contribute not only to more efficient and economical operation, but to bettering the operator's position as well.

In a prepared discussion of this paper, *F. E. Stuart,* Activated Alum Corp., Baltimore, Md., described experiences with new developments in a number of plants, and expatiated on the value of consulting engineer guidance and advice in small plant operation.

"The Proposed New Procedures of the State Health Department for the Bacterialogical Analysis of Water Samples," by DR. VERNER NESBIT and J. C. RHODES, Chief and Assistant Chief of the Philadelphia Laboratories of the State Department of Health.

The junior author, presenting this paper, traced the development of procedures followed by the State Laboratory in bacterial examination of water. The small 20 cc. sample bottle used since 1919 for mailing samples has now been replaced by a 3 ounce sample bottle. This new size of sample will be standard for state, city, and private company samples.

Samples will be examined on the basis of procedures selected from Standard Methods, but the number of inoculations used will enable reporting a minimum of 2 coli per 100 cc., not quite meeting Treasury Dept. standards which include a minimum of 1 per 100 cc. Brilliant green bile will be used as standard media to permit more rapid confirmatory reports.

This paper was discussed by *J. H. Beltz,* Chemist, Bell and Beltz, Philadelphia, Pa., who commented extensively on the advantages of using brilliant green bile media. It has been employed since 1933 for over 1000 parallel tests in these laboratories, showing close agreement with tests requiring longer incubation. If anything, this media appears to show error on the safe side, that is, to indicate positive tests where none are actually found. He believes the very considerable study of this medium by various investigators proves it to be an entirely acceptable alternate method.

"Pre-, Post-, Super-, and Dechlorination," by HARRY A. FABER, Research Chemist, The Chlorine Institute, Inc., New York, N. Y.

Based on the fact that the killing of bacteria is the main reason for chlorination of water, this paper was devoted to discussion of the newer knowledge of the action of chlorine. It considered growth and death of bacteria, the mechanism of disinfection, and the particular function of chlorine in various points and methods of application.

(1) *Myron G. Mansfield, Morris Knowles, Inc., Engrs., Pittsburgh, Pa.* (2) *Carl A. Hechmer, Jr., Chemist, Activated Alum Corp., Baltimore, Md.* (3) *Harry J. Kraum, Jr., Penna. Dep't. of Health, Meadeville, Pa.* (4) *E. A. Manz, Penna. Dep't. of Health, Philadelphia.* (5) *Past-president Wm. C. Emigh, City Engr., Coatesville, Pa.* (6) *S. P. McBride, Chemist, Shenango Valley Water Co., Sharon, Pa.* (7) *Chas. H. Young, Distr. Engr., Penna. Dep't. of Health, Meadeville, Pa.* (8) *H. B. Gulden, Boro Engineer, State College, Pa.*

Evidence provided by studies of several investigators working on the superchlorination process was illustrated by slides. It was shown that this process may become generally used as a method for disinfection which possesses a high safety margin, as well as for taste and odor control at many treatment plants, without alteration of existing processes. The explanation of many facts in chlorination treatment were given in order to provide better understanding of plant results. [We would add that Mr. Faber's informal lecture packed much into the time used in giving operators a clearer understanding of modern chlorination in a simple clear cut manner.—ED.]

Some New Aspects of Metaphosphate Treatment Develops

"The Use of Hexametaphosphates in Water Works." by OWEN RICE, Research Engineer, Hall Laboratories, Pittsburgh, Pa.

Mr. Rice described the present state of knowledge concerning use of this material known to the trade as "Calgon." (See article in Data Section, WATER WORKS & SEWERAGE, April, 1940, page 103.) Particular reference was made to the fact that all studies indicate the protective effect of metaphosphate to metallic pipes to be effective at all values above pH 5.0. Frequently zeolite softened waters show a pickup of iron content, and recent studies from a textile mill prove this can be prevented by use of "Calgon." Another application is the use of "Calgon" to prevent precipitation of iron in supply systems. The metaphosphate appears to be almost quantitatively absorbed on metal surfaces and to act very much in the same direction as do protective coatings as an oxidation (rusting) barrier.

R. B. Adams, Chemist, Pennsylvania Water Co., Wilkinsburg, Pa., in discussing this paper in reality presented a complete paper in itself, recording and discussing results on the Wilkinsburg system. Two effects of Calgon seemed especially important: (1) When applied ahead of the filters about half of the phosphate added was removed, calcium phosphate deposit was being found in the beds; (2) There appeared a loosening of old manganese coatings and coincidentally increased bacterial counts were noted in the far reaches of distribution mains.

At certain river stages, to accomplish manganese removal from the raw water (which is acid because of mine drainage) the required pH of 9 to 9.2 has caused an accumulation of carbonate in the distribution system. At other times manganese deposits in the mains. Twenty days of applying Calgon was required to stabilize such deposition through the system when applying less than 1 p.p.m. of the phosphate. A general increase of bacterial counts took place through the system when Calgon was used and when treatment was stopped the counts declined. Laboratory studies showed Calgon to have a stimulating effect on bacterial growth.

[Mr. Adam's paper deserved a lot of discussion, but time limitations prevented such.—ED.]

"Pipe Cleaning," by ALBERT FRANK, Engineer, National Water Main Cleaning Co., New York, N. Y.

Mr. Frank discussed the general problem of iron corrosion, tuberculation, and incrustation. He described in detail the equipment used for cleaning pipes of various sizes and the conduct of cleaning operations such as were witnessed by most of the members during an actual demonstration of the "real" thing. The dollar and cents value of main cleaning was cited, with typical instances of costs and returns.

N. V. Bureau, Superintendent, Mountain Water Supply Co., Greensburg, Pa., in discussing this paper, quoted data with reference to increases in carrying capacity and to savings accruing from cleaned mains.

Cathodic Protection Experience

"Cathodic Protection of Steel Stand Pipes," by G. WEBBER KNIGHT, Manager, Natroma Water Co., (Penna. Salt Mfg. Co. subsidiary), Natrona, Pa.

Mr. Knight cited the basic considerations in corrosion phenomena and in corrosion prevention. He applied theoretical considerations, particularly to explaining attack on steel water tanks. Essentially the maintenance of a protective hydrogen film on the metal surface explains the success of cathodic protection. The equipment was described, and actual results obtained at Natrona with an installation made in 1938 were quoted. Scale removal first took place, and excellent protection of the metal surface has since been provided. Mr. Knight, in closing, read a statement which seems to clear the waters muddied by claims of patent infringements.

Frear Hall—the Noisy Dorm.

Discussion by *E. H. Ingle,* General Manager, Electro Rust-Proofing Co., Dayton, Ohio, referred especially to the early description of this equipment published in WATER WORKS & SEWERAGE, and the excellent description appearing in the April, 1940, issue, page 81 of Data Section. Of special importance is the modern copper oxide type of rectifier which is practically of indefinite life—certainly more than twelve years of service can be counted upon. Since this part of the equipment is the only part, except electrodes, to require replacement, the operating cost becomes little more than the current required. Deterioration of electrodes is increased by highly acid or highly alkaline waters, but stainless steel has proven quite long lived—no visible loss in 3 to 4 years and 10 year life assured. In giving cost data in reply to questions on this point he cited in general the following. Investment of $150 upwards for equipment; for a 100,000 gal. tank, $350 to $375, but the same equipment is good for larger tanks. Graphite electrodes less costly but require somewhat more current; in acid and sulphur waters graphite preferable. From many waters some calcium is plated on the steel as well as the hydrogen film. Concerning the patent discussion the process is far from new and the only patentable feature applicable to tank protection is in respect to the method of grounding—not in the basic method or the equipment employed.

[For an excellent discussion and analysis of "Cathodic Protection" we direct attention to the paper by E. E. Norman, of Kalamazoo, Mich., presented before the 1940 A.W.W.A. Convention. A digest of his paper appears elsewhere in this issue under caption "The Kansas City Convention."—ED.]

JOINT MEETING PROUD OF SAFETY RECORD

The Joint Meeting, which operates many miles of sewers (serving Essex and Union Counties in N. J.) and a treatment plant located in Elizabeth, N. J., takes pride in its safety facilities, training and resultant safety records. Its very active Safety Committee has recently reported to the Joint Meeting, from which report the following has been taken.

Accident Records: Our investigation of the records show that nine minor accidents occurred at the treatment plant during the year 1939. The loss of 112 hours time due to two of these accidents represents two-tenths of one per cent (.2%) of the total work hours of the year.

On General Sewer Maintenance our investigation revealed that only two very minor accidents occurred for the year of 1939. There being no loss of time for these accidents, your committee feels that the employees are entitled to a 100% rating.

In summarizing the above we find that the total number of hours worked on both sewer maintenance and treatment plant operations amounted to 73,479 hours and the actual hours lost due to accidents amounted to 112, representing fifteen hundredths of one per cent (.15%).

Safety Equipment: Your committee made an examination of the safety equipment carried on the motor trucks and wish to report that the equipment has been maintained in excellent condition. We have particularly made examination of the new additional piece of safety equipment, the Oxygen Inhalator. This piece of equipment contains two 16 cu. ft. cylinders, each containing 93% oxygen and 7% carbon dioxide, having a pressure of 2,000 lbs. to each tank, together with one face-piece and the other necessary mechanism for its proper operation.

In case the supply of oxygen-carbon dioxide mixture should become depleted a tank of straight oxygen, such as used with welding outfits, can be substituted in an emergency.

We have also made an examination of the various instruments used in the detection of gases, etc. We find that there is one combination unit for the detection of explosive gases and oxygen deficiency, which seems very intricate in its operation. As we have other units for the detection of explosive and poisonous gases we are of the opinion that it would be advisable that a separate unit for the detection of oxygen deficiency be obtained. Since an oxygen deficiency lamp complete with fittings can be purchased at a cost of $30.00, your committee recommends that this unit be purchased.

In our examination of the motor equipment we find that none of our motor equipment was involved in any accidents during the entire year.

Items Under Consideration: Your committee has observed on their tour of inspection that no means were available for communication between the men working in the sewers and the men on the surface. We, therefore, are investigating a portable voice-powered telephone which operates without the use of electric current or batteries, thereby eliminating any possibility of becoming the source of ignition in the sewers.

First Aid Supplies: In the course of our examination we have paid particular attention to the various first aid kits carried on motor trucks and installed at the treatment plant and garage, and in connection therewith we wish to say that we found that they were maintained with the necessary supplies and that an additional stock is carried on hand for any replacements.

In conclusion the record obtained during the entire year of 1939 is a fine one. Employees should be commended for their co-operation in minimizing accidents.

The Safety Committee is composed of Robert O. Thompson (Chairman), Charles R. Teller and Milo S. Borden.

The Federation Reorganization

What IS, and What Is NOT Contemplated

We hope that this page is sufficiently read to justify our decision to put it to use, with the hopes of informing the greatest possible number concerning the status of the proposal to create a National Sewage Works Association. Further, we shall attempt to clarify what is a seeming confusion or misunderstanding concerning the proposed aims and plans of those responsible for the movement.

Possibly the very term "National Sewage Works Association" is in itself responsible for one important misconception —namely, that such an association is intended to supplant or absorb the several existing state or regional sewage works associations. A more truly descriptive term is the National *Federation of Sewage Works Associations,* which in reality is all that the proposal and plans under way contemplate. In short, the existing state and regional associations are already constituted units of a Federation of Sewage Works Associations which has been in existence for twelve years. Its Board of Control has always been composed of elected members 2 from each member association in the Federation) chosen by the individual associations as their representatives. The Board has always had a Chairman, a Vice-Chairman and a Secretary-Treasurer, elected by its members at meetings held annually.

The Board has chiefly (practically exclusively) concerned itself with matters pertaining to the Federation Journal and other publications produced or sponsored by the Federation. It has had functional and policy committees and takes action on their recommendations, and those of the Editor and Business Manager of the Journal. Beyond this, any activity that might be considered as National in scope has been too limited to recall—nor has the set up under the existing Federation Constitution permitted any effort toward coordinating the work of individual member associations or committees in such that have been concerned with problems of national interest or import.

Further than this weakness, the Board has been dependent upon gratuitous services in the business management of the Sewage Work Journal and has had to accept financial assistance at each year end from the paternalistic Chemical Foundation, in order to keep the Journal in a solvent condition. Putting it another way—in order that the Journal could continue to be distributed to members of the various associations at the unbelievably low price that has been paid. Now, due to the recent death of Wm. W. Buffum, who has from the beginning so well served as Business Manager of the Journal without compensation, the Federation now faces a new and real dilemma. It has lost a real friend.

Something must be done, regardless of all else, to put the Journal on a sound footing. No better way has seemed available than through an effort to create a stronger Federation with a paid executive officer to handle its business affairs and, through coordination and committee work of national scope, to strengthen the activities and advance the growth of the Federation. Still a further reason is that of holding an annual Sewage Works Convention of national and strength giving scope, such as has been so effectively demonstrated by other major associations—notably the American Water Works Association in recent years.

After deliberate consideration and a preponderant vote, cast by officials of the 25 Federation associations, favoring a start this year with the First Annual Convention of the Federation, committees are at work and arrangements are now well under way toward this accomplishment. A vote, favoring staging the first convention in a mid-western city, plus an offer of sponsorship from the Central States Sewage Works Association, resulted in the decision to hold the first convention in Chicago, October 3rd to 5th. Hotel Sherman, offering special rates and considerations, was selected as the headquarters hotel.

To tell more concerning the aims and plans of the Federation's Committee on Reorganization and Expansion, we can not do better than quote from a recent release by the Committee on Publicity.

"First and foremost, it is the basic aim of the movement to strengthen—not to change—the set-up of the Federation. The primary objective is that of improving the professional position of all workers in the broad field of sewage treatment, particularly sewage plant operators. These public servants need and deserve a strong national voice. They need a strong, central coordinating group. They need the necessary training and education to secure continual advancement on a merit basis, together with civil service or some other guaranty of tenure of office.

"A strong national Federation is proposed as the best possible means for improving the professional, economic and social status of the individual members of the local associations. Furthermore, such a strong national Federation is expected to take a leading and active part in advancing, on a national scale, the best tenets of modern sanitary engineering practice.

"In its new and revitalized form, it is proposed to make no change whatsoever in the basic Federation set-up as it has existed for the past 12 years. It is to continue, as before, as a Federation not of individual members, but of local affiliated associations. There is definitely to be no interference from headquarters, direct or indirect, with the activities of the local, member associations. These are to retain, just as they always have, complete freedom of action with respect to local affairs.

"How then, one may ask, are these aims to be realized. First, it is planned to establish a strong, central executive office with a full time Executive Secretary, to take over all routine business; to procure advertising for the Journal; to maintain closer contact with the member associations and thus to put the business end of the Federation on a par with that of other national, professional associations.

"Committee work will be greatly broadened in scope and strengthened, particularly with respect to the establishment of uniform standards of procedure in plant design and plant operations; and in producing standard specifications to cover sewage works equipment and materials. For such work, funds in a central treasury must be available.

"It is proposed that the scope of the Sewage Works Journal be extended, and particularly to broaden its value to a greater number of small plant operators. At the same time it will be published monthly as early as funds permit.

"An annual Federation convention is proposed, to be held alternately in different cities throughout the country, with extensive provision for exhibits by manufacturers. In addition, means may be provided for similar exhibitions at the meetings of the local associations.

"Funds to finance the expanded work of the Federation are to be provided by increasing the dues for full members to $3.50 per year. For operator members the dues will be set as low as permissible—$2.50.*

"To allay rumors which have gained a fair degree of credence in certain parts of the country, and led to a good deal of confusion, a word or two seems in order on exactly what the plan does *not* propose to do.

"The reorganization plan definitely does not envisage any combination whatsoever with any other association. Neither have the sponsors of the plan entered into any agreement with any group of manufacturers for financing the work of the revitalized Federation. It should be stated, however, that a plan under consideration will permit an organized manufacturers' group to be affiliated with the Federation."

In most respects the latter plan, if consummated, is to be patterned from that which has been successfully employed by the American Water Works Association, without manufacturer domination or interference. On the contrary there has been valuable cooperation and strength in the affiliation.

In brief, the matter of exhibits at conventions and at local meetings are placed in the hands of the Water Works Manufacturers Association. In return the manufacturers pay into the Association treasury a lump sum for that privilege. There are no strings to its use. Looking to the possibility that a similar affiliation might result from the present Federation movement, the Water Works Manufacturers Association has recently reorganized into the Water and Sewage Works Manufacturers Association. Now, strictly sewage equipment manufacturers are entitled to participate in the activities of the Association, which has a Water and a Sewage Division. Thus the broadened Association is in a position to affiliate with and aid the proposed National Federation of Sewage Works Associations.

L. H. Enslow

[*Even a lower rate is being considered for grades of operators least able to pay for the Journal.—Ed.]

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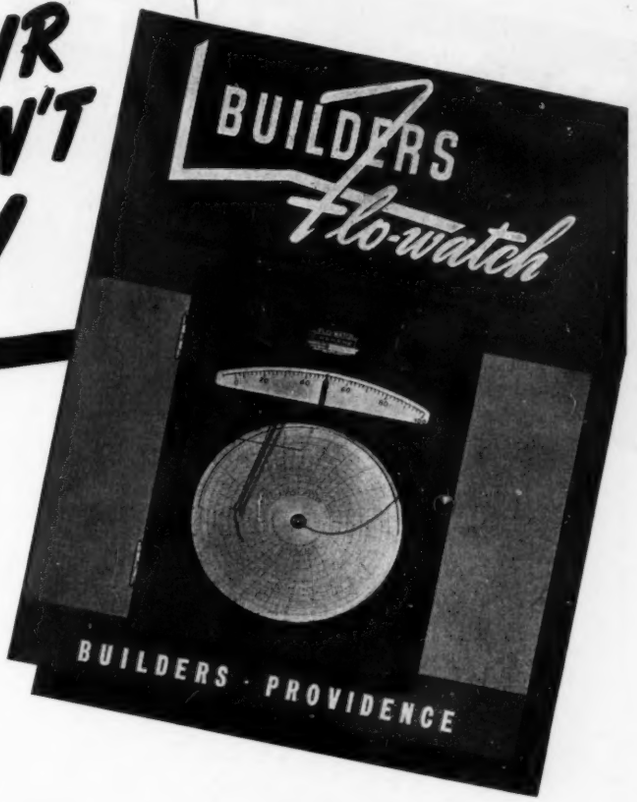

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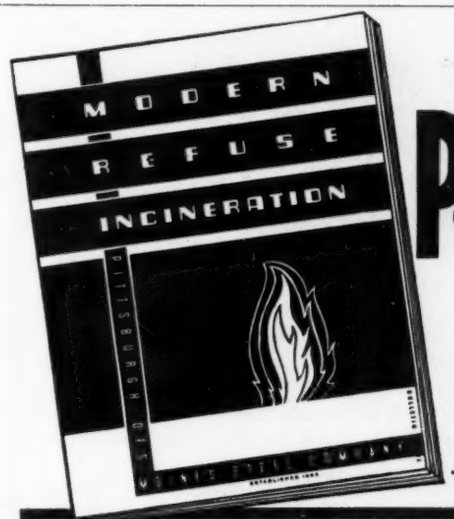

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SANITATION EQUIPMENT

MEETINGS SCHEDULED

Aug. 14—Boothbay Harbor, Maine
Maine Water Utilities Association. Sec.-Treas., Earle A. Tarr, Winthrop, Me. (Future Meetings Scheduled—Oct. 9—Millinocket; Dec. 12—Mexico).

Sept.—Wahpeton, North Dakota
North Dakota Water & Sewage Works Conference. Sec'y.-Treas., Lloyd K. Clark, State Dep't. of Health, Bismarck, N. D.

Sept. 11-13—Ann Arbor, Mich. (Univ. of Michigan Union)
Michigan Conference on Water Purification. Sec.-Treas., R. J. Faust, Michigan Dept. Health, Saginaw, Mich.
(Meeting Jointly with)
Michigan Section A.W.W.A. Sec.-Treas., M. N. Gerardy, 803 Water Board Bldg., Detroit, Mich.

Sept. 16-17—Denver, Colo. (Cosmopolitan Hotel)
Rocky Mountain Section A. W. W. A. Secretary, R. V. Howe, State Office Bldg., Denver, Colo.

Sept. 18-20—New Castle, Pa. (Castleton Hotel)
Western Pennsylvania Section A.W.W.A. Sec.-Treas., E. P. Johnson, 418 Flannery Bldg., Pittsburgh, Pa.

Sept. 24-27—New York, N. Y. (Commodore Hotel)
New England Water Works Association. (59th Annual Convention). Secretary, Frank J. Gifford, 613 Statler Bldg., Boston, Mass.

Sept. 30-Oct. 2—Detroit, Mich. (Book-Cadillac Hotel)
American Public Works Association. Exec. Director, Frank W. Herring, 1313 E. 60th St., Chicago, Ill.

Oct. 1-2—Columbus, Ohio (Neil House)
Ohio Conference on Sewage Treatment. Sec'y., B. M. McDill, State Department of Health, Columbus, Ohio.

Oct. 3-4—Columbus, Ohio (Neil House)
Ohio Conference on Water Purification. Sec'y., T. R. Lathrop, State Dep't. of Health, Columbus, Ohio.

Oct. 3-5—Chicago, Ill. (Hotel Sherman)
First Annual Convention
Federation of Sewage Works Associations
Sponsored by
Central States Sewage Works Association
Gen'l Chairman, George J. Schroepfer, Box 3598, St. Paul, Minn. Local Chairman, Dr. F. W. Mohlman, San. Distr. of Chicago, 910 So. Michigan Blvd., Chicago. Sec'y.-Treas. Central States Ass'n., W. H. Wisely, Ill. State Dept. of Health, Springfield, Ill.

Oct. 8-11—Detroit, Mich. (Book Cadillac Hotel)
American Public Health Association. Exec. Sec'y., Dr. Reginald M. Atwater, 50 West 50th St., New York City.

Oct. 10-11—Glens Falls, N. Y.
New York Section A.W.W.A. Sec'y.-Treas., R. K. Blanchard, 50 West 50th St., New York City.

Oct. 14-17—Tulsa, Okla. (Mayo Hotel)
Southwest Section A.W.W.A. Secretary, Lewis A. Quigley, 3320 W. Berry Street, Fort Worth, Texas.

Oct. 14-16—Manitowoc, Wisc. (Hotel Manitowoc)
Wisconsin Section A.W.W.A. Sec'y.-Treas., L. A. Smith, City Hall, Madison, Wisc.

Oct. 16-17—Springfield, Mass. (Hotel Kimball)
New England Sewage Works Association. Sec'y.-Treas., LeRoy W. VanKleeck, State Dep t. of Health, Hartford, Conn.

Oct. 16-18—Atlantic City, N. Y. (Haddon Hall)
Pennsylvania Water Works Association. (45th Annual Meeting.) Secretary, F. Herbert Snow, 507 Telegraph Bldg., Harrisburg, Pa.

Oct. 18-19—Atlantic City, N. J. (Madison Hotel)
New Jersey Section A.W.W.A. Sec.-Treas., C. B. Tygert, Box 178, Newark, N. J.

Oct. 21-23—Lexington, Kentucky (Hotel Lafayette)
Kentucky-Tennessee Section A.W.W.A. Sec.-Treas., H. D. Schmidt, State Dept. of Health, Nashville, Tenn.

Oct. 23-26—Los Angeles, Calif. (Los Angeles-Biltmore Hotel)
California Section A.W.W.A. Secretary, Burton S. Grant, 207 So. Broadway, Los Angeles, Calif.

Oct. 24-25—HUNTINGTON, W. Va.
West Virginia Section A.W.W.A. Sec'y.-Treas., J. B. Harrington, Dep't. of Health, Charleston, W. Va.

Oct. 28-30—RALEIGH, N. C. (Sir Walter Raleigh Hotel)
North Carolina Section A.W.W.A. Sec'y.-Treas., R. S. Phillips, 319 E. Trinity Ave., Durham, N. C.

(Meeting jointly with)

North Carolina Sewage Works Association. Sec'y., M. F. Trice, State Board of Health, Raleigh, N. C.

Nov. 7-8—ST. PAUL, MINN. (Hotel St. Paul)
Minnesota Section A.W.W.A. Sec.-Treas., R. M. Finch, W. & T. Co., 416 Flour Exchange, Minneapolis, Minn.

Nov. 7-8—WILMINGTON, DEL. (Hotel Du Pont)
Four States Section A.W.W.A. Sec'y.-Treas., Carl A. Hechmer, Washington Suburban Sanitary Dist., Hyattsville, Md.

Nov. 13-15—OMAHA, NEB. (Fontenelle Hotel)
Missouri Valley Section, A.W.W.A. Sec'y.-Treas., E. L. Waterman, Univ. of Iowa, Iowa City, Ia.

LITERATURE AND CATALOGS

"A Hundredth Anniversary," being celebrated this year by Worthington Pump and Machinery Corp. of Harrison, N. J., is commemorated in a handsome 77-page volume, which deserves more than casual mention. From "The Planting of the Seed in 1840" by Henry Rossiter Worthington, who then invented his first little boiler feed pump for canal boats, up to today, the history of Worthington is complete. The old wood-cut illustrations are interesting, including the first Worthington municipal water pump—that for Savannah, Ga.—and Worthington's piston type water meter of 1855. Then came the famed Worthington Duplex Pumping Engine, which won a gold medal at the Philadelphia Exposition in 1876. More history of the Worthington Co., which absorbed other companies to build the great Worthington Pump and Machinery Corp. of today. The latter half of the volume is devoted to a picturized cross section of typical Worthington installations comprising pumps of all kinds, water meters, Diesel engines and gas engines which have so effectively been employed for by-product power reduction in sewage plants. With the chapter "Looking Forward," we have reached the 77th and last page of "100 Years of Worthington."

"Sulphate of Alumina—in Water and Sewage Treatment" is the topic of a new booklet published by General Chemical Company, to bring up to date a general picture of the adaptations of what is commonly termed filter alum (sulphate of alumina) in water purification and treatment of sewages and dewatering of sludges. A section is devoted to betterment in taste and odor removal by effectively performed flocculation and adsorption to reduce the load on more costly odor removal processes. Most of the brochure, however, is devoted to modern chemical treatment of sewages, trade wastes and sludges. In this advance the peculiar merits of sulphate of alumina as a coagulant are set forth and picturized by performance graphs. Its wide range pH zone of effective coagulation is emphasized and its simplicity of use stressed. Particular attention is given this coagulant in speeding sludge dewatering and relieving overload on digestors and sludge drying beds. For a copy of "G. C. Aluminum Sulphate"—the address is General Chemical Co., 40 Rector Street, New York City.

"Water Treatment"—is discussed in an 84-page Technical Bulletin published recently by Solvay Sales Corporation's Technical Service Division. An earlier publication of the same nature (Bul. No. 11) deals with "Methods of Water Analysis." The present booklet effectively covers water treatment (industrial and

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Indicative of the growing popularity of this economy pipe for water and sewerage lines, is the recent installation of 8500 feet of 10" Mono-Cast Roll-On-Rubber-Ring Joint Pipe for water pipe line extensions at Cambridge, Neb., a town of 1500 population. This pipe is manufactured in 16-ft. lengths by the Mono-Cast Centrifugal Process in diameters 4" to 12", inclusive, and is furnished from high strength iron in lighter weight than standard specification Cast Iron Pipe. It is ideal for installations where first cost may dictate selection of pipe. Write for detailed literature.

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municipal) in general. It is replete with useful graphs and tables of conversion factors and data. It closes with a chapter devoted to chemical feeding equipment. The publication is rather definitely up to date and presents an opportunity to water works to secure a very worthy treatise on water treatment at no charge. For a copy of Bul. No. 8 or Bul. No. 11 (or both), write Solvay Sales Corp., 40 Rector Street, New York City.

"FORD Setting and Testing Equipment—For Water Meters" is believed to be the handsomest and most complete catalog ever produced by Ford Meter Box Co. Here are some of the splendidly pictured sections—"How Good Basement Meter Settings are Made"; "Making Good Pit Settings and Freeze Prevention"; "Adaptations of Ford Yokes"; "Copper Horns"; "Copper Setters"; "Resetters"; then follows the newest Ford products "Ring Style Valves, Couplings and Fittings"; "How to Effectively Test Water Meters and Adaptation of the 'Testerate' Flow Indicator." Other Ford products and accessories complete the 48-page Catalog No. 40. In our opinion, no water works catalog file should be without it. If you haven't a copy, write Ford Meter Box Co., Wabash, Ind.

"Valves, Hydrants and Sluice Gates—by Ludlow" are presented in a new Catalog and bulletin from the Ludlow Valve Mfg. Co., manufacturers of valves and hydrants since 1866. The first is a complete catalog of the many Ludlow items from Automatic Air Release Valves to Yard Hydrants; the second presents Ludlow's complete line of Sluice Gates and Floor Stands for Water and Sewage Works. In respect to its profusely illustrated pages, revealing special features and details, the new catalog is especially worthy. For Catalog 201, and Sluice Gate Bul. S. 39, write Ludlow Valve Mfg. Co., Troy, N. Y.

"Roots-Connersville Sewage and Water Plant Equipment"—is the subject of a new 20-page bulletin from Roots-Connersville Blower Corp., which is replete with technical information and illustrations of interest. Discussing, first, the important part played by air in sewage treatment and water purification, the operating principles of the famed R-C Positive Displacement Blowers are described, and performance charts presented. Considerable space is devoted to R-C Blowers direct connected to gas engines in a number of modern plants. A section is devoted to R-C Gas Meters, built on the same principle as the blowers. Another section to R-C Blowers in water aeration; recarbonation and air-filter wash systems. Vacuum Pumps for vacuum filters and pump priming are also covered and there is even an R-C Water Meter. For a copy of Bul. No. 23—B-12, write Roots-Connersville Blower Corp., Connersville, Ind.

"On Selecting Pump Materials"—is our caption of a leaflet from Allis-Chalmers Mfg. Co. which deals with the effect of water conditions on the selection of pump materials. It points out the necessity of carefully investigating the type of water to be pumped and presents a number of qualities in water that affect performance and service. This paper discusses the effect of these various factors on different pump materials, with particular reference to the influence of pH value. The information required to select intelligently the proper materials for pumps is outlined and a chart included reveals the proper materials recommended for various pH ranges. For a copy of this guide (Reprint R-6108) write Allis-Chalmers Mfg. Co., Milwaukee, Wisc.

"The Nichols Herreshoff Incinerator" is presented in a 36-page "Wire-O-Hoop" bound bulletin from Nichols Engineering and Research Corp. It describes in detail the multiple hearth type incinerator, now installed

in an imposing list of 35 sewage plants (named) since its first application at the Dearborn, Mich., plant in 1934. Many of these installations are pictured, at least one such being designed also for sludge drying, as long as there is use for the material. The smallest units seem to be 9'3" diameter and the largest 22'3" diameter, four of the latter being installed at the new Detroit plant. The splendid illustrations show the component parts of these rabbling type dryers and destructors. For Bul. No. 210, write Nichols Engineering & Research Corp., 60 Wall Tower, New York City.

"Protective Coatings for Water Works" is the caption of a new bulletin from The Barrett Company, manufacturers of Barrett Coal Tar Base Enamels and protective coatings for water works and sewerage equipment and structures. In addition to its illustrated attractiveness this new publication contains in a slip-out pocket a separate booklet devoted to the very new "A.W.W.A. Standard Specifications for Coal Tar Protective Coatings for Steel Water Pipe." Every user or potential buyer of steel pipe should have these specifications in this handy booklet for filing. For a copy, write The Barrett Co., 40 Rector St., New York City.

"Toledo's Water Supply Project" involving many miles of steel pipe lines protected with bituminous enamels, is the subject of a reprinted article distributed by The Barrett Co., whose bituminous water works enamels were employed as the protective coating on 9 miles of 78 inch main conduits. Some very interesting views on the project are shown. For a reprint of "Toledo's Lake Erie Water Project" and other well put together literature on Barrett Water Works Enamels, address The Barrett Co., 40 Rector St., New York City.

"Hypochlorinators by W. & T." are presented in a recent folder from Wallace and Tiernan Co. Three styles are pictured (1) Electric Motor Drive (subject to automatic start and stop); (2) Water Meter Drive (for proportional feeding); (3 Water Motor Drive (emergency type, manual control). Model No. 1, with a 40-watt motor, will operate against pressures up to 125 lbs. and it is assumed that No. 2 will do the same. Pointing out the east of installation, ruggedness, and inexpensiveness, these W. & T. Hypochlorinators are especially adaptable to small supplies and as emergency units. For literature, address Wallace and Tiernan Co., Newark, N. J.

"The 'Flexible' Method of Pipe Cleaning," described in a folder from Flexible Under-Ground Pipe-Cleaning Co., involves the use of Flexible Steel Rods with a turning power drive. To the business end of the rod in the pipe line are attached the cleaning heads, which whip away the encrustations. Likewise is pictured the method employing the spring toothed "go-devil," more familiar to water works men, which is propelled through the main by water pressure. In small lines the rod method is most effective, as also with lines badly encrusted with dense scale. Afterward the "go-devil" may be put through as a finishing off procedure. In the folder are testimonial letters from municipalities where the Flexible Method has been employed, and examples of tough jobs done are cited. For the "Flexible" literature, write Flexible Pipe Cleaning Co., 9059 Venice Blvd., Los Angeles, Calif.

"Diagnosing Manhole Trouble"—tells of the ills of rattling manhole lids and a prescription of cure—namely "Tapax" Manhole Cushion Tape, made of indestructible asbestos, and reinforced with bronze mesh in a variety of widths. A page of "Directions" pictures the "HOW" of "Tapaxing." Several pages tell the "WHY." Such takes the form of testimonials from users, not the least reason for stopping manhole bang being better public relations. For a copy of "Curing Manhole Trouble" write Tapax Mfg. Co., Mamaroneck, N. Y.

BIG NEWS,

too!

% Proportioneers, Inc. %
have been awarded contract for largest number of hydro-chlorinators ever purchased on one order, we believe. Order covers

125 CHLOR-O-FEEDERS

—purchased by Chicago real estate company for installation in new residential sub-division.

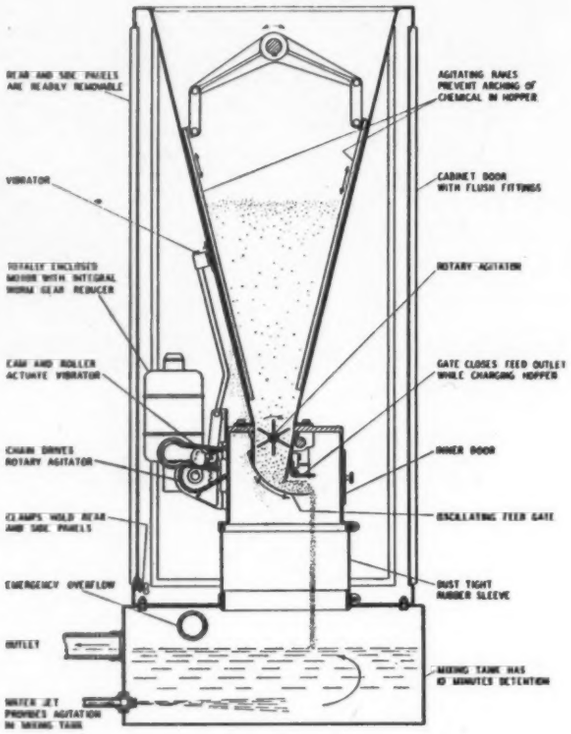
ALSO

Two Pur-O-Pumpers just ordered for West Point—the best is none too good for those boys! Can we serve you—ask for Bulletin "MAR".

% Proportioneers, Inc. %
9 N. CODDING STREET, PROVIDENCE, R. I.

EQUIPMENT NEWS

NEW DRY FEEDER BY PERMUTIT



● The new Dry Chemical Feeder, just announced by the Permutit Company, is a volumetric type feeder which features the oscillating principle of feed, a generous solution box, and stepless increase and decrease in feed adjustment. It is subject to manual or automatic proportional operation.

The accompanying line-drawing saves many words of description. The curved monel-metal feed gate oscillates to feed a ribbon of chemical which drops into the jet agitated dissolving tank below. This important unit provides a 10 minute dissolving period at maximum feeding rates, thus insuring effective economy producing solution and dilution.

The length of arc travelled by the oscillating feed gate (determining feed rate) can be varied while the feeder is in operation by setting a non-moving adjusting screw. This screw moves the fulcrum of an ingenious system of levers, thus producing the desirable step-less adjustment of feed rates up or down.

Hopper agitation involves an arrangement of side-wall agitating "rakes" which move up and down the walls. A side wall exterior vibrator consists of a rubber tipped hammer which strikes the hopper wall at every revolution of the crank shaft. In addition, a rotary toothed agitator revolves in the hopper spout to break up lumps and to maintain free flow of chemical to the oscillating gate. A shut-off gate is provided above the feed spout. And, extension hoppers are available to add 4 cu. ft. to the 6 cu. ft. capacity of the standard machine hopper.

Dust prevention is cared for by enclosing the feed spout in an inner cast-iron housing with a large access door. The whole mechanism is enclosed in a welded steel cabinet with a full length door and removable side panels. The motor is of dustproof design.

(Continued on next page)

Today—Simplex Sand Expansion Indicators are insuring wash water savings and greater efficiency of filtration in large and small—new and old—plants.

In plants whose capacities are as low as 1 m.g.d. and as great as 30 m.g.d. SIMPLEX SAND EXPANSION INDICATORS are proving their worth as an aid in securing proper filter washing. Longer filter runs and reduction in wash water usage are resulting in noteworthy savings. Let us show *you* how this inexpensive device will help you in reducing *your* operating costs.

●

Write for Data

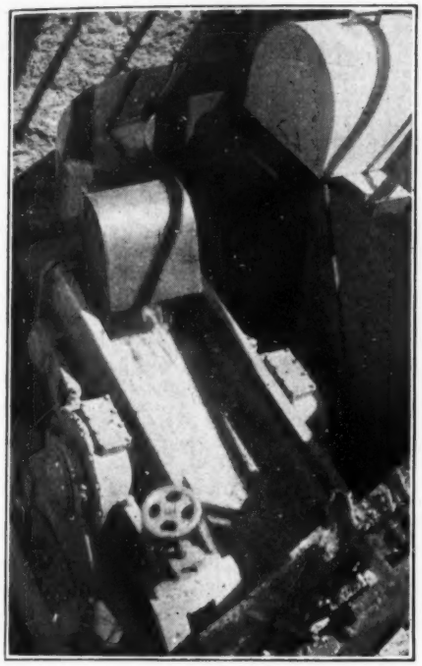
SIMPLEX VALVE & METER CO.

6743 UPLAND STREET • PHILADELPHIA, PA.

The ratio of feed is 1:40 and capacities per day are 70 to 1300 lbs. of alum; 40 to 700 lbs. of lime; 15 to 200 lbs. of activated carbon; 60 to 1250 lbs. of ferric sulphate. Proportional feed is secured by relayed interrupted operations, transmitted at intervals from the contact instrument activated by the master meter.

For bulletin No. 2345, describing and effectively illustrating the new Permutit Oscillating Chemical Feeder, write The Permutit Co., 330 West 42nd St., New York City.

"Selectro" Screens for Sewages and Wastes



"Selectro" Screen Operating at a Vegetable Canning Plant

● What is reported by users to be a very efficient and trouble free fine-screen, for removing suspended solids from wastes or sewages, is the "Selectro" Screen manufactured by Productive Equipment Corp. of Chicago, and The Canadian Locomotive Co. of Toronto, Canada.

The 18" x 60" unit pictured herewith has a screen of 40 mesh and is handling 250 to 300 g.p.m. of corn canning waste. These screens, built in widths of 2 to 5 ft. and lengths 4 to 12 ft., have long been employed in the food and chemical industry.

The "Selectro" Screen features the fully adjustable tilt and throw adjustment which is so valuable in change of capacity, and degree of separation regulation. Ease of screen cloth washing and change of cloth are other advantages emphasized. Further, the unit (motor and all) will operate when actually submerged.

The stroke adjustment (8 throw intensities) of this shaker type eccentric screen is simply made, and tilt adjustment is made without even slowing down the unit. The vibrator assembly and all moving parts operate in a sealed oil bath.

(*Continued on next page*)

Model NSB-4
—one of twelve.

The 3,000th Royer was made and shipped in June of this year—proof that these Royers used by sewage treatment plants to disintegrate sludge and by florists, parks, cemeteries, estates and golf clubs to shred and mix compost and to mix-in shredded sewage sludge and fertilizers, have proved themselves completely satisfactory.

Many users have reordered from one to ten machines. They have found that sewage sludge is finely disintegrated and aerated, further drying it, by the fast, thorough shredding action of the Royer's "combing belt."

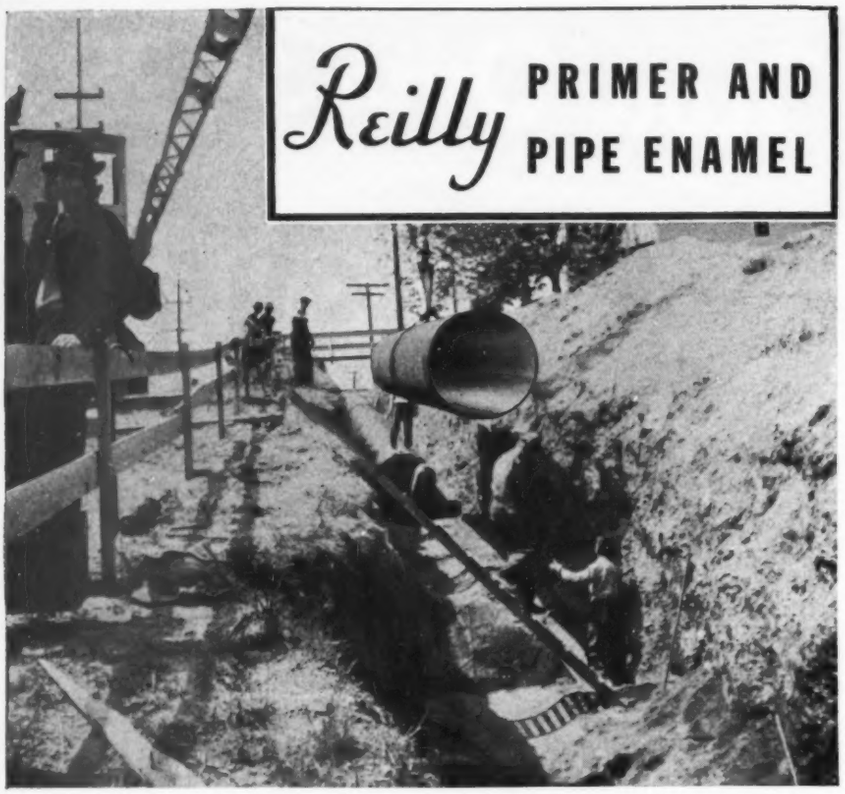
Get the facts on these cost-cutting machines that convert sewage sludge cake into a readily marketed product for use by parks, golf clubs, florists and amateur gardeners.

Twelve rugged, all-metal models from $250.00 up. Electric, gasoline and pulley driven. Each removes trash, loads into trucks or onto piles. Greatly cuts labor costs.

Send for Bulletin 140.

ROYER FOUNDRY & MACHINE COMPANY
170 Pringle Street, Kingston, Pa.

THE ROYER



The Best Insurance FOR A SAFE,

ADEQUATE AND PERMANENT WATER SUPPLY

● Reilly Primer and Pipe Enamel provide dependable protection of steel surfaces against the ravages of rust, corrosion and abrasion. Applied to the inner, as well as the outer surfaces, they offer an effective preventive of diminished flow resulting from incrustation and tuberculation.

These coatings bond firmly and smoothly to the metal, and safely withstand a wide range of temperature, without sagging, chipping or peeling.

Leading water-works engineers in all sections of the country have found REILLY Coatings easy to apply by any of the usual methods. Equally effective on small pipe or large mains and conduits, or on tanks and other metal surfaces. For further information communicate with nearest REILLY office, or write direct to Indianapolis.

REILLY TAR & CHEMICAL CORPORATION

Executive Offices: Merchants Bank Building, Indianapolis, Indiana

2513 S. DAMEN AVENUE, CHICAGO, ILLINOIS 500 FIFTH AVENUE, NEW YORK, N. Y. ST. LOUIS PARK, MINNEAPOLIS, MINN.

FIFTEEN · PLANTS · TO · SERVE · YOU

"Selectro" Screens for Sewages and Wastes

(*Continued from page 77*)

For descriptive "Selectro" Bulletins No. 1237 and 239 write, Productive Equipment Corp., 4600 So. Kedzie Ave., Chicago, Ill., or The Canadian Locomotive Co., Toronto, Ont.

The "Centrifilter"

(A Continuous Centrifuge and Filter)

● The "Centrifiler" has made its appearance in the sewage field. It is a unit which dewaters sludges through application of high speed centrifuging, in which the liquid leaving the sludge cake is effectively clarified by filtration as it, as well as the dewatered cake, leaves the machine continuously at different points.

Starting and stopping batch type centrifuges has always been an undesirable, time, capacity and power wasting operation. A successful continuous centrifuge has much to attract the attention of sewage works engineers and designers. One which filters, or otherwise produces a relatively clean centrifucate (liquid effluent), will receive the deserved attention of engineers and operators.

A description of the "Centrifilter" is far too involved to successfully give in this limited space, but the basic feature is the use of **centripetal** force in the filtration stage and **centrifugal** force in the dewatering and solids compacting stage. Both proceeding simultaneously, or in very close step at least. The filtration is effective through the myriad thin bladed "Baleen" Filter, on which solids removed do not accumulate.

This very ingenious (to us rather difficulty understood) continuous centrifuge, perfected under the direct supervision of H. Burdette Cleveland, Sanitary Engineer, is described in considerable detail and minutely illustrated in a recent brochure. This novel unit may make sludge dewatering history. If the reader would like to know more about it and its possibilities, request the brochure from The Centrifilter Corp., 452 Fifth Ave., New York City.

YEOMANS ROTARY COMPRESSOR FOR GAS BOOSTING

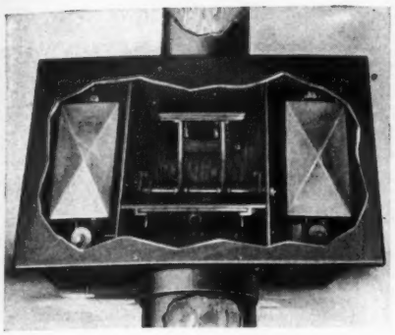
● A new application for Yeomans Rotary Compressors—long used in ejector operation in connection with Yeomans Shone Sewage, Screenings and Sludge Ejectors—is represented in the recent installation as a gas pressure boosting unit in the Duluth, Minn. Sewage Treatment Plant.

At Duluth, Yeomans Rotary Compressors take the gas from the digesters at 8 to 10 inch water head and boost such to 25 to 30 lbs. for storage in a 36 ft. Hortonsphere. The gas leaving the pressure vessel is reduced in pressure, through automatic pressure reducing valves, as it enters the low pressure system for plant use in power production or heating.

Yeomans Compressors are of the multi-cellular positive displacement, oil lubricated type. The compressor blades are of a heat resisting non-scoring composition which takes all of the wear, and are easily and inexpensively renewed in time. Force feed oil lubrication (sight feed) is a feature. In place of conventional stuffing boxes ground metal shaft seals, with automatic take up, are employed. These seals require no attention and remain tight even against ammonia gas in many installations. The compressor cylinders and shaft seal chambers are both water jacketed.

From our knowledge, there are many sewage plants which could advance gas use economy by employing some type of compressor in the system. If any reader would like to know more concerning this application of compressors (boosters) they should request further details from Yeomans Brothers Company, 1423 N. Dayton St., Chicago, Ill.

New Sewer Discharge Regulator



McNulty Unit Regulator

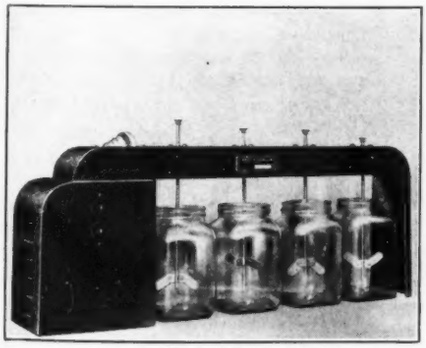
● The McNulty Engineering Co. has just announced a new Unit Regulator.

In addition to eliminating the need of large chambers, each unit is completely factory assembled and adjusted. Thereby, field assembly is no longer required. Set to pass a specified quantity and ready for insertion in the lines, the new McNulty flow regulators are available in the popular sizes at a fraction of the cost of earlier models.

A few of the outstanding advantages of the new McNulty Unit Regulator are: the elimination of the float chamber and the reduction of regulator chamber size; its adaptability to existing manholes; its corrosion-resistant construction, (built entirely of Everdur bronze or aluminum, depending upon the type of sewage to which it is to be exposed); tail water control; the ease and simplicity of installation. It is self-cleaning; and, most important, it is extremely accurate in control and lower in cost.

For descriptive literature and details, write The McNulty Engineering Co., 200 Old Colony Ave., South Boston, Mass.

New Model Omega Laboratory Stirrer



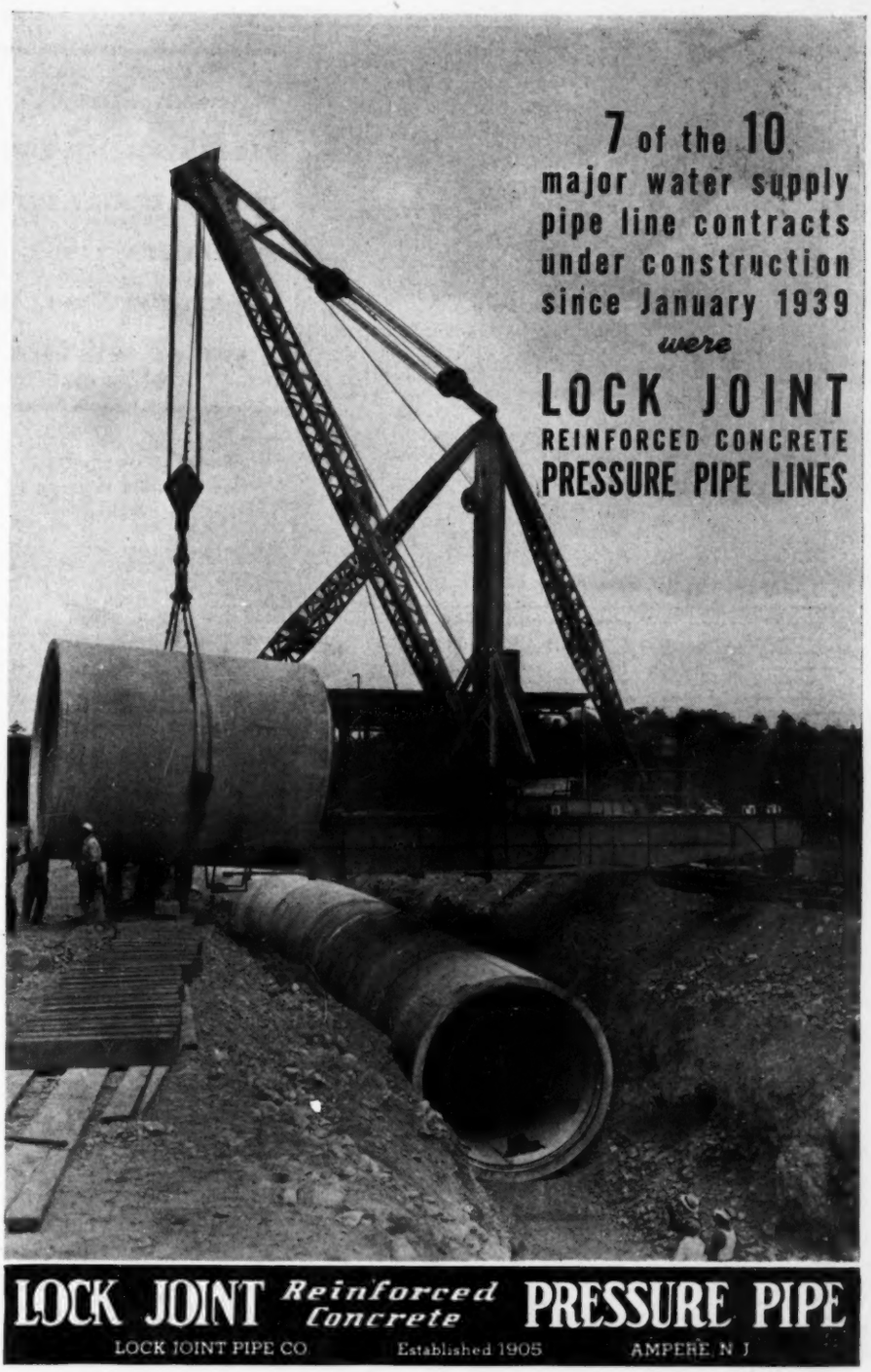
Omega Laboratory Stirrer

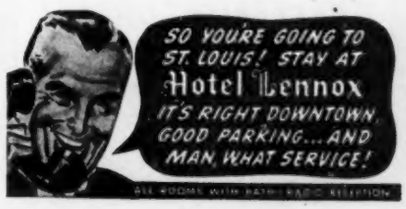
● Omega Machine Company announce a new 1940 stream-lined model of the Omega Laboratory Stirrer. In the new model all of the time proven worthy features are retained and improvements added. Fluorescent daylight illumination for observing floc is one new feature that may be had.

The dependable and noiseless worm gear drive to individual paddle shafts, and pulley belt drive from 1/6th h.p. motor to the horizontal main shaft, assures absence of slippage and constant speed for all paddles. Folding paddles allow for periphereal speed adjustments from 1 ft./sec. (tip-speed) to 0.5 ft./sec., or less if desired. Speed variations by belt-pulley changes are 32, 50, 75, 100, 150, 200 R.P.M. on the standard stirrer. Others can be had.

All units are 7" wide and 17" high. The 4 unit stirrer, here pictured, is 40" long; the 6 unit machine being 65" in overall length. Sturdily built, the 4 unit machine weighs 60 pounds. Jars of 1 gal. capacity or 1 qt. capacity available as preferred (1 gal. jars being pictured).

For literature and prices write Omega Machine Co., 4010 Penn Ave., Kansas City, Mo.





84" pipe—Spring Lake, N. J.

FLANGED PIPE

FLEXIBLE JOINT PIPE

BELL & SPIGOT PIPE

SPECIAL CASTINGS

SHORT BODY BELL & SPIGOT SPECIALS

Large stock enables us to make prompt shipments.

CAST IRON PIPE

SIZES 2" TO 84"

Warren Foundry & Pipe Corp.

11 Broadway, New York

Warren Pipe Company of Mass., Inc.

75 Federal St., Boston

LEADITE

The Pioneer Self-Caulking Material for C. I. Pipe

AND ANOTHER USER SAYS—

"Actual Footage of Mains in Our System Laid With Leadite Joints"

4"	1,661 ft.
6"	236,610 ft.
8"	44,347 ft.
10"	1,114 ft.
12"	58,974 ft.
16"	4,680 ft.
20"	681 ft.
24"	14,733 ft.
30"	11,531 ft.
Total	374,331 ft.

THE LEADITE COMPANY

Girard Trust Co. Bldg., Philadelphia, Pa.

No Caulking

BEFORE CLEANING — THE NATIONAL METHOD — AFTER CLEANING

CLOGGED PIPES

Made Good as New

THE NATIONAL METHOD OF WATER MAIN CLEANING makes your old pipe practically as good as new. Every department is subject to loss through the ravages of time upon its distribution system. The cleaning out of this foreign matter inevitably leads to increased pressure and flow, improved health conditions, and lowered operating costs.

Our illustrated Booklet, "The Cleaning of Water Mains," will be sent upon request.

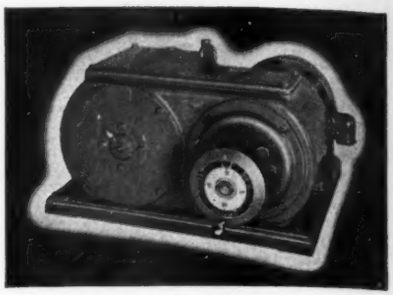
NATIONAL WATER MAIN CLEANING CO.

30 Church Street, New York, N. Y.

BRANCHES

115 Peterboro St., Boston, Mass.
910 William-Oliver Bldg., Atlanta, Ga.
7103 Dale Ave., St. Louis, Mo.
208 E. Forsyth St., Jacksonville, Fla.
3812 Castellar St., Omaha, Neb.
205 W. Wacker Drive, Chicago, Ill.
501 Howard St., San Francisco, Calif.
58 Pelham Ave., Toronto, Canada

Reeves "Speedial" Handwheel



Reeves "Speedial" Handwheel

● Reeves Pulley Co. announces a new, improved type of handwheel-speed indicator for use with Reeves Variable Speed Transmissions, Vari-Speed Motor Pulleys and Motodrives.

This equipment, known as the "Speedial," very accurately indicates speed settings of the different units. The actual indication is a definite number of turns of the speed shifting screw of the unit.

The Speedial is offered as optional equipment (at slight extra cost), in place of the standard speed control handwheel and indicator on the various Reeves drives; and is also available for use on units already in service.

Depending upon the speed ratio of the unit with which the Speedial is to be used, gear ratios of 20:1, 30:1 and 60:1 are available. The dial is calibrated accordingly.

For further information concerning the new "Speedial" write Reeves Pulley Co., Columbus, Ind.

"Laytex" Wire A Development of U. S. Rubber Co.

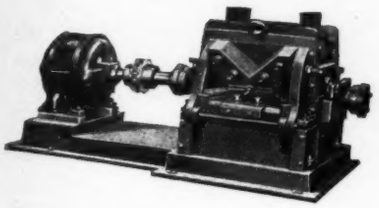
● "Laytex" Wire is a new U. S. Rubber Co. product, especially suitable for wiring buildings in an economical manner. These wires are so inconspicuous as to permit their installation on the surface of walls.

"Laytex" Wire is produced by the dip and pass method of applying the very thin latex to the wire. However, despite the markedly reduced thickness of insulation, the new wire fully meets the requirements of the National Electrical Code and the Electrical Committee of the National Fire Protection Association.

The first applications of latex coated wire were those of the U. S. Signal and Control Service in the U. S. Navy, where the insulation has been for 10 years subjected to extreme moisture conditions.

For further details concerning this interesting product, write U. S. Rubber Co., Wire Division, Rockefeller Center, 1230 Sixth Ave., New York City.

The Diamond "Hog" (A Screenings and Garbage Disintegrator)



● The "Diamond Hog" is a ruggedly constructed machine manufactured for some years by Diamond Iron Works of Minneapolis, for fine to coarse cutting up of refuse materials from industrial operations; notably lumber mills, meat packing plants and fertilizer works. It therefore should prove applicable in garbage, refuse and sewage screenings disintegration. We understand that more than 5,000 "Diamond Hogs" have been placed in the industrial field, performing wet or dry disintegration.

The feature of the roller-bearing "Hog" is continuous one-pass reduction, the materials being shear-cut (sections from 0.014 inch upwards) through adjustable knife settings, simply and quickly made. The patented element is the novel double-anvil feature, preventing slivers and stringy materials from passing uncut.

The "Diamond Hog" is built in 8 different sizes, ranging from 4 to 35 tons per 24 hours, for belt or direct motor drive.

For further details and literature on this robust refuse disintegrator, write Diamond Iron Works, Minneapolis, Minn.

"Wire Nuts" Eliminate Wire Soldering or Makeshift Taped Jointing

● To many of our readers "Wire-Nuts" such as are supplied by Ideal Commutator Dresser Co. of Sycamore, Ill., will be news.

These socalled "Wire-Nuts", made of a strong insulating plastic, are employed for connecting two or more wires together in a neat and safe manner. Their use eliminates twisting, soldering and taping and precludes corrosion of such connections. These simple cylindrical "nuts" contain a threaded core. Into the open end the bared wires are inserted and by twisting the "nut" all wires are securely twisted together. At the same time the threads are pressed into the wires to produce excellent contact and hold them against any possibility of being pulled out of the insulated amalgamating cone.

These Ideal "Wire-Nuts" are fully approved by Underwriters' Laboratories, Inc., and are particularly advantageous for making wire connections in cramped quarters and exposed locations.

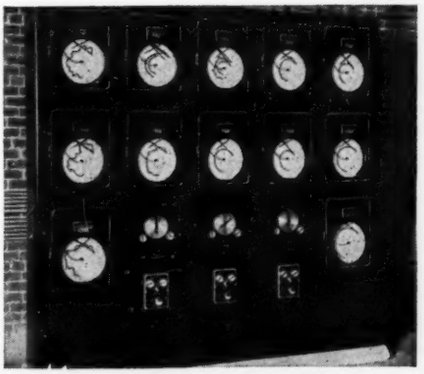
For descriptive leaflet and a free sample of 4 "Wire-Nuts" offered for trial, write Ideal Commutator Co., 1252 Park Ave., Sycamore, Ill.

THE *Bailey Synchro-Meter* GIVES YOU *Flexibility* IN METERING APPLICATIONS

● This meter panel includes both direct mechanically operated Fluid Meters and Bailey Synchro-Meters, which are electrically operated by remote transmitters.

Wherever you have need for a central meter panel incorporating both mechanically and electrically operated Fluid Meters, it is possible to maintain uniformity and neatness by employing this system of transmitting meter and recorder readings.

MU-17



Readings of flow, pressure, temperature, liquid level and other factors are accurately and quickly transmitted from out-of-the-way places to the receiving indicator, recorder or integrator by the Bailey Synchro-Meter.

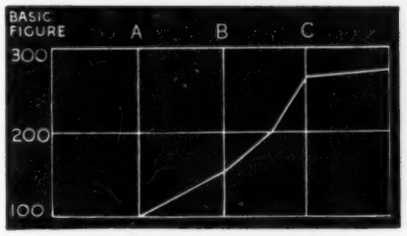
This electrical mechanism which is completely described and illustrated in Bulletin No. 194-A, can also be used to eliminate the necessity of running high pressure piping up to meter and control panels.

Write for your copy of this new Bulletin.

BAILEY METER • COMPANY •

1072 Ivanhoe Road, Cleveland, Ohio

BAILEY METER COMPANY LTD., MONTREAL



VACUUM FILTERING COSTS LOWERED

To ascertain which is more economical, a series of plant runs was conducted, using three different coagulants. Carefully kept records covered:

Weight of Wet Cake
Per Cent Solids
Pounds Dry Cake
Solutions Used in Inches
Pounds per Inch
Total Pounds Used (Anhydrous)
Per Cent Used to Dry Solids
Costs

. . . . and here is the record of Filter Yield:

Material	"A"	"B"	"C"
	7.53 lbs.	6.74 lbs.	5.38 lbs.

per square foot per hour

Setting cost of **ISCO FERRIC CHLORIDE** (Material "A") at 100—the cost of other materials proved to be:

Material "B" 151 Material "C" 254

ISCO FERRIC CHLORIDE cost 51% less than "B" 154% less than "C"

Doesn't this suggest that you should write at once for more information about

ISCO FERRIC CHLORIDE

INNIS, SPEIDEN & CO.

117 LIBERTY STREET, NEW YORK, N. Y.

Chicago Cleveland Boston

Philadelphia Gloversville, N. Y.

ONLY THIS *Sulphur Base* PIPE JOINTING COMPOUND OFFERS THESE ADVANTAGES!

Tegul-MINERALEAD is quick-healing. Back-filling and clearing-up can start at once ● 10-lb. INGOT-Form; easy to store, ship and handle ● Impervious to rain and flood; can be stored in the open ● Ingot form can't change composition; mixed right, it stays right—to point of use ● Needs no skilled labor ● No caulking or deep bell holes ● Makes tough, flexible, permanently tight joints, much more than ordinarily resistant to thermal and mechanical shock ● Write for money-saving information on jointing of Bell and Spigot Main. The ATLAS MINERAL Products Company of Penna., Mertztown, Pennsylvania.

Tegul- MINERALEAD

IF Your Sewage effluents are high in suspended solids;

Or, you have a Water Problem;

Or, desire to Recover a product now wasted;

Or, you are disturbed by Stream Pollution;

Or, are in any way interested in the removal of suspended solids from liquors;

You should investigate the

Laughlin Modified Rapid Sand Filter

BECAUSE, it is a simple automatic, continuous flow apparatus, designed on familiar lines, to accomplish a purpose without adding to the operator's troubles.

LAUGHLIN EQUIPMENT CORPORATION
270 Madison Ave., New York City

STOP CORROSION
with CARSON MECHANICAL JOINTS
● **CHARCOAL IRON BOLTS** ●
for Cast Iron Pipe and Fittings
WRITE FOR PRICES AND FURTHER INFORMATION
CARSON CADILLAC CORP.
1221 PINSON ST. BIRMINGHAM, ALA.

When you think of
ALUM
... think of
ACTIVATED
●
ACTIVATED ALUM CORPORATION
Curtis Bay Baltimore, Maryland

WITH THE MANUFACTURERS

Attractive Films for Public Showing

"Nuchar" Manufacturers to Release Educational Color Films Designed to Popularize Water Supply

● Many have already seen the attractive color films which Industrial Chemical Sales Division of the West Va. Pulp and Paper Co. has been showing at recent water works association meetings.

Those who have will be pleased to learn that the producer of these films, to meet suggestions of those who have seen them, is soon to have ready several extra copies for loaning out to operators and others who may find it opportune to show such educational films before local civic organizations, clubs, high schools, etc.

The films under production are being made up and edited so as to bring the story of water supply and purification before as many citizens as possible, and in an understandable and attractive fashion.

There are without question hundreds of operators who will consider the availability of these films a remarkable opportunity to show the public at large "What's Behind the Water Spigot."

In making this announcement we may be accused of "jumping the gun" a bit—but we take this opportunity of suggesting to our readers that since only a limited number of films are to be available, they should make application promptly for a position on the "first come first served" list. Address, Industrial Chemical Sales Div., West Va. Pulp and Paper Co., 230 Park Avenue, New York City.

Comminutor Patents Held Valid

● Notice from Chicago Pump Company reveals the fact that they have received a favorable decision from the U. S. District Court (Northern District of Illinois) supporting their claims of infringement of basic patents covering the Chicago "Comminutor." This novel unit was developed for the comminution of sewage solids within the sewage proper, its application to serve the function of a sewage screen as well as a solids disintegrator.

The manufacturer against whom Chicago Pump Co. entered suit of infringement has been held by the U. S. District Court to be an infringer and enjoined from continuing. An appeal has been made to the U. S. Circuit Court of Appeals. However, the decree as it now stands constitutes an affirmation of the novelty of the Chicago Comminutor and validity of the claims cited in the covering patents 1,948,125 (Nordell) and 1,960,303 (Durdin)—assigned to Chicago Pump Company.

Royer Disintegrator No. 3000 Rolls Out

● Executives and employees of the Royer Foundry & Machine Co., Kingston, Pa., gathered on June 5th to witness the completion of the 3,000th Royer Disintegrator.

This Royer, a Model "NSB-4", is one of 12 models now widely used by sewage treatment plants to process sewage sludge cake so that it can be more readily used as a soil improver.

Sewage sludge with a moisture content as high as 51% is readily shredded to pea size by these machines. The product may, if desired, be enriched with chemicals and marketed as a more complete fertilizer.

Flanigan Becomes Chain Belt's New York Manager

● Chain Belt Co. has announced the appointment of Mr. G. B. Flanigan as New York District Manager to succeed Mr. W. H. Quinn who died recently after seventeen years' association with the company.

Mr. Flanigan entered the employ of the company immediately after graduation from Yale University in 1925. For several years he was located at Milwaukee, in both manufacturing and sales departments, and in 1928 became a member of the New York District sales force. In 1937 he was appointed Chicago District Sales Manager, which position he leaves to manage the New York District with offices at 220 East 42nd St., New York City.

R. E. Mitchell Heads New Paint Company

● Robert E. Mitchell, formerly Manager of paint sales for Joseph Dixon Co., has been named president of the recently organized Paint Engineers, Inc., manufacturers and paint consultants, whose factory and offices are located in Hawthorn, N. J.

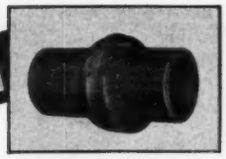
With the Dixon Co. Mr. Mitchell has had a highly successful career and leaves with many friends wishing him continued success.

Penna. Salt Makes Ellsworth Manager of Advertising

● Mr. H. M. Ellsworth, who for many years was Advertising Manager of the Sterling Products Co. (now owned by Pennsylvania Salt Mfg. Co.) was made Manager of Advertising of Pennsylvania Salt Manufacturing Co., and all of its subsidiaries, effective July 1, 1940.

Mr. Ellsworth succeeds Miss I. J. Dennery, resigned.

WESTON



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- No jute used—gasket centers spigot.
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This is a sturdy, dependable heavy duty feeder.

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Wilson Chemical Feeders, Inc.

BUFFALO, NEW YORK

The Meter-Master

RATE RECORDER FOR WATER METERS

Send For Literature

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246 Palm Street, Hartford, Conn.

Pittsburgh Meter Installs First Field Service Truck

(Others to Follow)

● As a service and convenience to their customers in the Midwest, the Pittsburgh Equitable Meter Co. and subsidiary, the Merco Nordstrom Valve Co. now have in operation, from their Chicago office, a completely equipped field service truck.

This truck is fitted with the necessary tools, lubricants and test apparatus to handle properly the field maintenance of EMCO and Nordstrom products. It is in charge of Mr. Paul Payton service engineer, who is thoroughly trained in factory methods and maintenance procedure on all the companies' products.

A similar unit has been ordered to operate out of the Tulsa office and we understand that such trucks are to be placed in service in other sections of the country in the near future.

Monsanto Magazine Voted Highest Award In House Magazine Group

● Monsanto Magazine, published monthly by Monsanto Chemical Company, has been voted the outstanding publication in its class (so-called Internal Group) by the House Magazine Institute of America.

The choice was made by a group of severe critics serving as judges, amongst which was the publisher and the designer of *Fortune* magazine. The award was made at a dinner at which Howard A. Marple, editor of Monsanto Magazine was guest of honor.

(We would here like to add our congratulations to editor Marple and his staff and our commendation of the Committee's choice; also to say that those of our readers who haven't done so should get their names on the list to receive "Monsanto Magazine." It will cost nothing more than the mailing of a request to Monsanto Chemical Company, St. Louis, Mo.—Ed.)

Harry T. McDonald Dies

● Engineers throughout the United States were shocked and grieved to learn of the sudden death of Harry T. McDonald, research engineer for Caterpillar Tractor Co., at his home in Peoria, Ill. He succumbed to a heart attack. Mr. McDonald had been employed by "Caterpillar" and its predecessor, The Holt Manufacturing Co., for 22 years. He joined the Holt company as a draughtsman. During the World War he was stationed at Camp Taylor in Montgomery, Ala. He was a member of the Officers' Training Corps, the United States Ordnance Advisory board, and the Society of Automotive Engineers. Recognized nationally as a leading authority on track-type tractor design, Mr. McDonald's advice was eagerly sought and his aid generously given to government departments in connection with the use and application of track-type machines. A native Peorian, Mr. McDonald was born Jan. 18, 1892. He attended the local schools and was graduated from Bradley Polytechnic Institute in that city.

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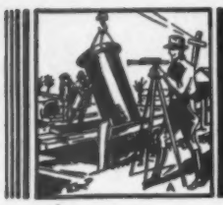

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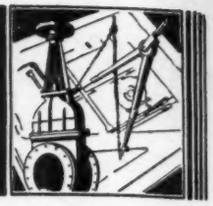

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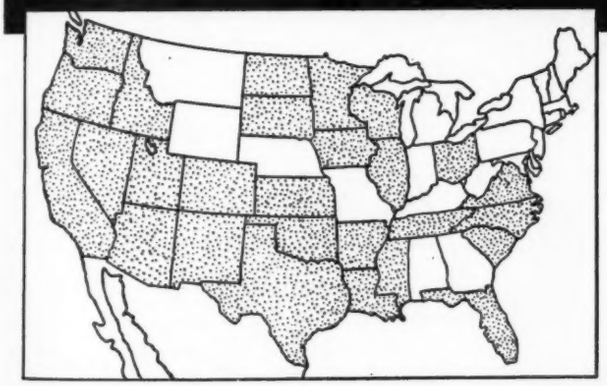
Is there Fluorine in Your Water Supply?



• Many water supplies in those areas shaded on the map above contain dangerous quantities of fluorine. Analyses have shown this element to be present in amounts that will mottle or even completely destroy tooth enamel. Such a disfiguration severely handicaps an individual for life.

• How Fluorex Purifiers effectively and economically remove fluorine from water and prevent mottling of tooth enamel is told in Bulletin 2500-A. Write for your copy.

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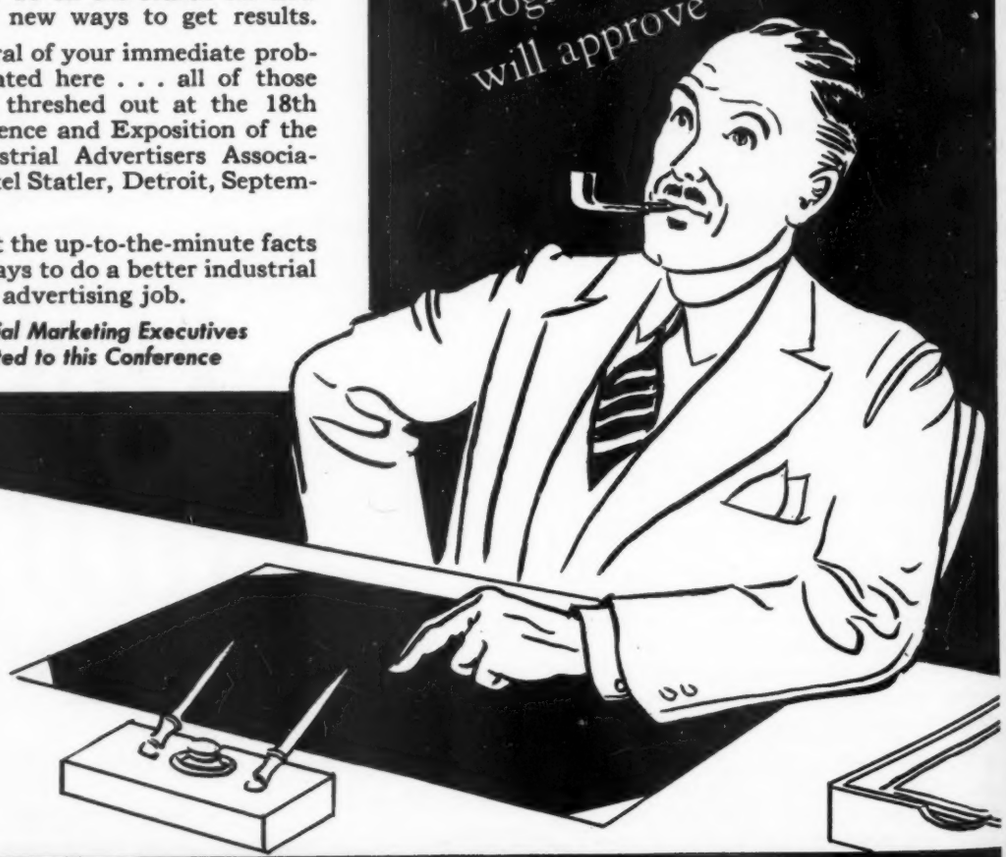
All Industrial Marketing Executives are Invited to this Conference



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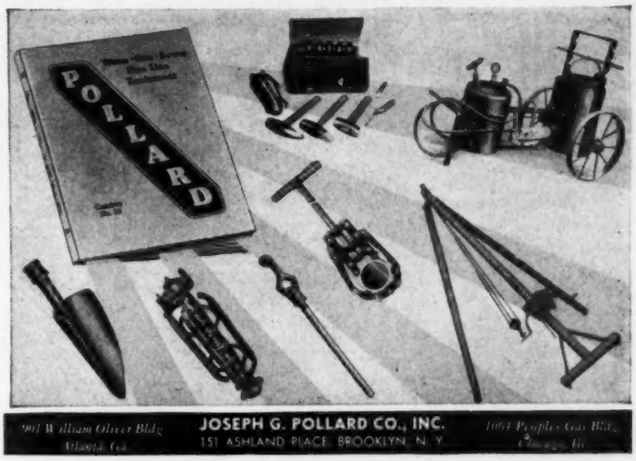

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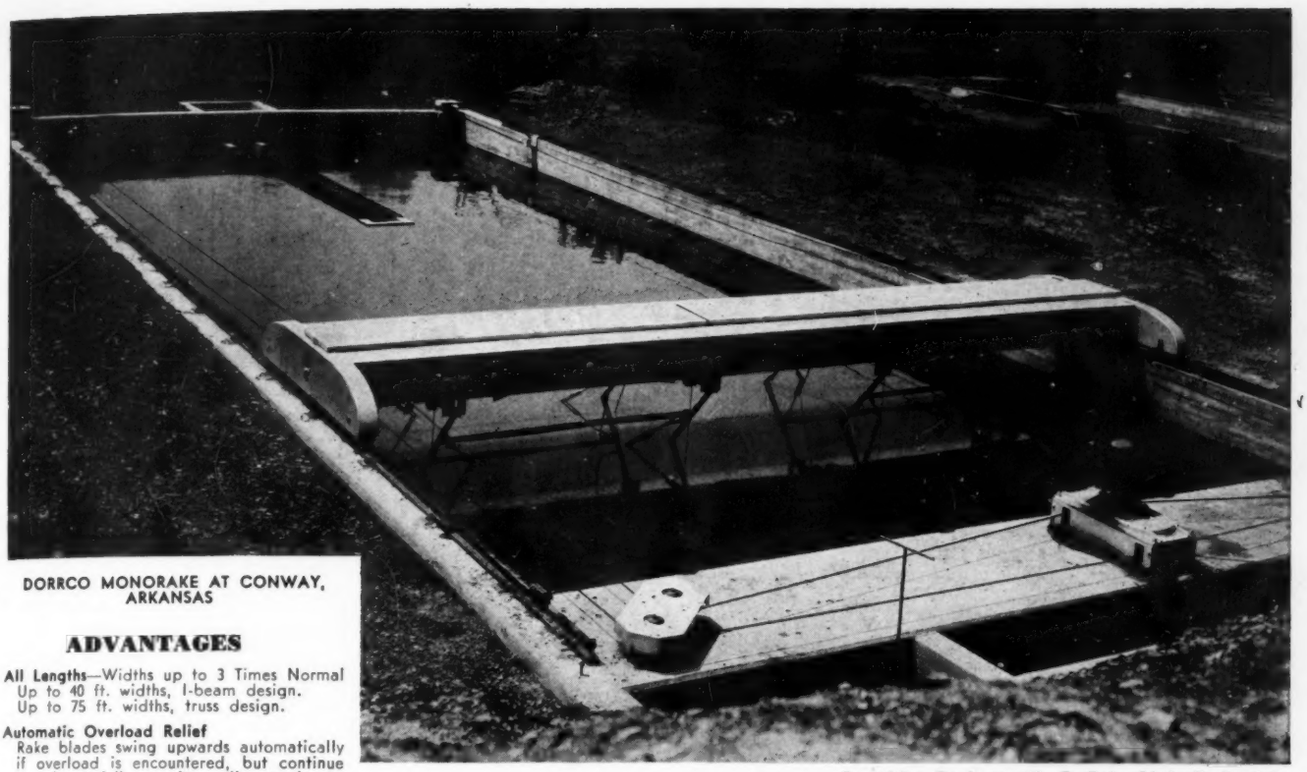
The DORRCO MONORAKE



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Up to 40 ft. widths, I-beam design.
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Under certain conditions it is feasible to drive two or more Monorakes from a single motor-drive unit.

CLOSE-UP OF RAKING MECHANISM

AN IMPROVED MECHANISM FOR RECTANGULAR SETTLING TANKS

The Dorrco Monorake, the resu't of a Development Program begun several years ago, is now represented by 25 successful commercial installations made over a period of 5 years. It is essentially a balanced raking mechanism for the continuous removal of sludge from *existing* rectangular sedimentation tanks.

It is available for tanks of any length and depth and, in single units, for widths up to 75 ft. Skimming in each direction may be provided where required. All metal to metal wearing parts are at all times above the water level.

Two balanced raking mechanisms, alternating in the raking and idling positions, are supported and operated from a traveling car. Two types of Monorakes are provided—the open type, illustrated above, and the submerged type where ice conditions are anticipated.

Dorrco Monorakes possess many new advantages cited at the left. Consequently these units are not subject to many of the limitations inherent in the conventional types of rectangular cleaning mechanisms.

Write for descriptive literature on the Dorrco Monorake — an improved rectangular sedimentation unit.

DORRCO

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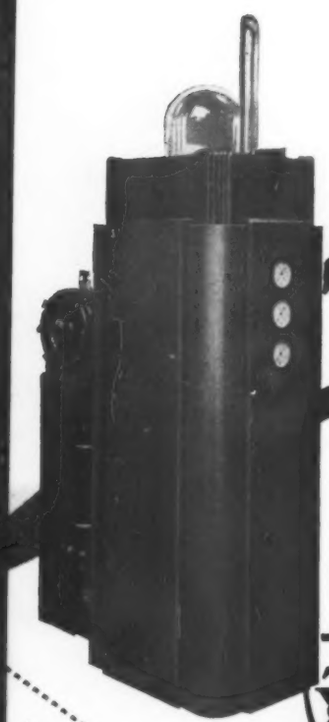

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